AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

The Hewes & Phillips Corliss Engine.

The engravings presented on pages 1 and 2 represent two views of the new design of Corliss engine, made at the Hewes & Phillips Iron Works, Newark, N. J. The cylinder is attached in the usual manner to a strong frame, having a broad and rigid support at the outer end of the cross-head slides, the object being to avoid the tendency, by springing, to throw the guides out of alignment.

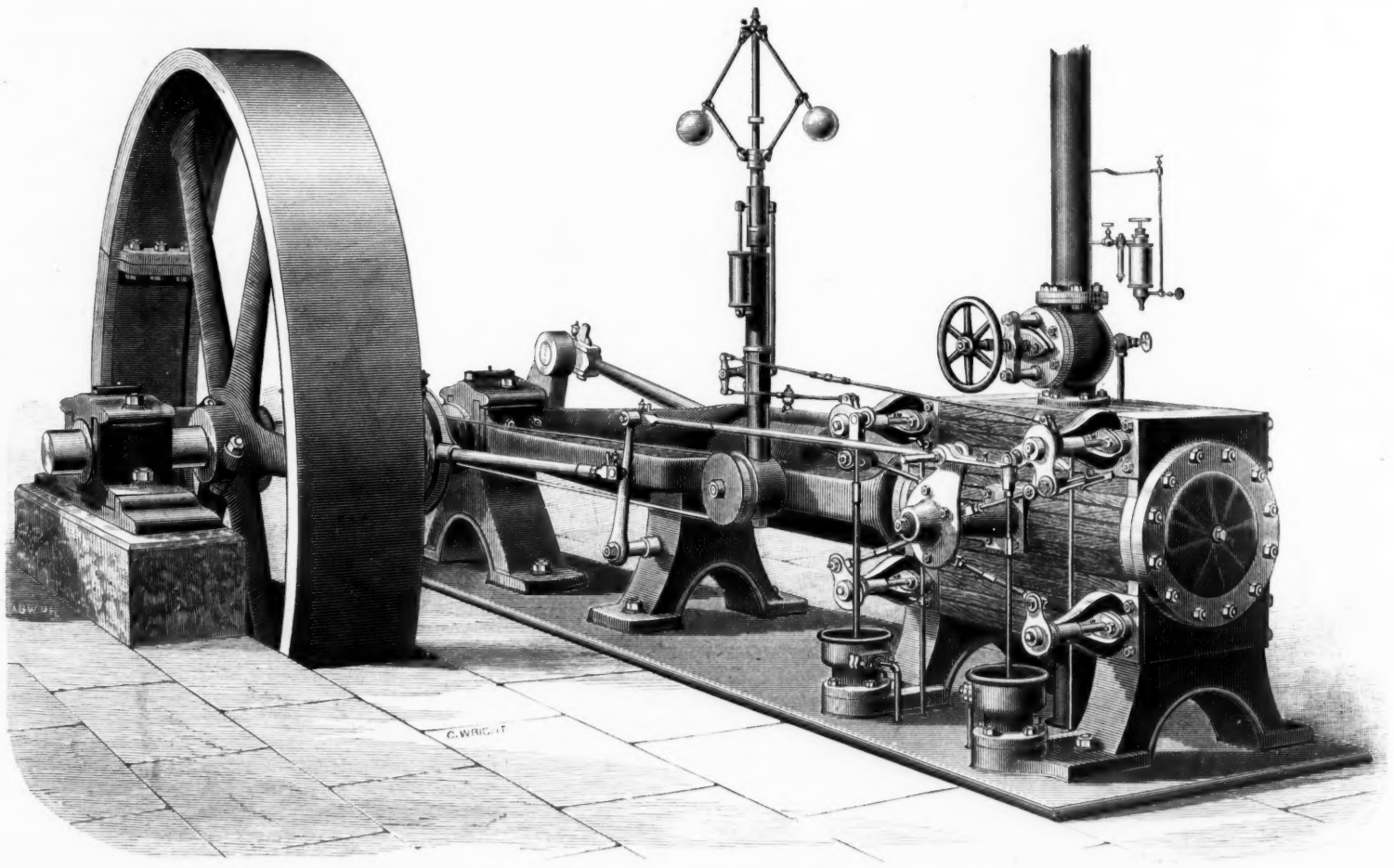
In the design of the valve gear, the aim has been to make the parts more easily accessible for adjustment and repairs, and also of greater durability. The crab-claw is provided with an elliptic spring, bolted together at the outer end, exerting its pressure on the long end of the lever, thus admitting of the use of a comparatively long and elastic spring, reducing the liability of the spring to set or break to a minimum. The swivel block and toes in the claws are made of tool steel, hardened on the working edges, and admit of being reversed in four different directions before being squared up by grinding.

The travel of the vacuum dashpot has been reduced to one-half the throw of the valve, making an easy lift for the toes, besides reducing the momentum of the buckets and the strain of opening the valve, it is claimed, to one-fourth of what it would be if the bucket travel equaled that of the valve. The dashpots are bolted to the extended legs of the cylinder, and are entirely above the floor level, the air cocks for regulating the vacuum being in plain sight and convenient for adjustment. The expressed air is led away in pipes under the floor, avoiding the noise of its escape.

One of the improvements in the valve gear is the bushing of the valve stem brackets on the outer end. This admits of the fit being easily renewed, both in the stem bearing and the brass wrist containing the cut-off toe. These bushes are of hard, close cast iron, pressed into place, with a feather to prevent turning, making an effective and simple method of preserving the alignment and renewal of these surfaces.

The cross-head is made with gibs having a wedge adjustment and babbitted surfaces. The piston rod is fitted on a long taper, and drawn firmly to a shoulder by a steel key driven from the outside, and kept from backing out by a split pin.

The governor has a simple device for changing the speed of the engine, consisting of a sliding weight placed on a rocking lever at the side of the governor. In adjusting the speed of the governor from the pulleys, the weight is placed central with the fulcrum of the bar, and a movement either way toward extremities will vary the speed, the extreme variation being about ten revolutions of the engine per minute, the exact change varying with the distance moved from the center. These engines are built in sizes from 12″ upward, each size being from separate patterns, the intention being to allow ample strength and large wearing surfaces, and to construct them in the best manner and of the best materials. They are made either condensing or non-condensing, simple or compound.



BACK VIEW OF CORLISS ENGINE AS BUILT BY HEWES & PHILLIPS IRON WORKS.

For persistence under circumstances that to an outside view look quite the reverse of encouraging, the advocates of the adoption of the metric system of measurement in this country take the lead. After several years' agitation, the extent of their progress may be summed up by saying they have succeeded in getting it taught in some of the schools. Further than this it stands in worse repute than it did ten years ago, because agitation has brought more to see its inconveniences. The latest move to compel its use is the attempt to get a sub-committee of the House Committee on Coinage, Weights, and Measures to recommend its more general adoption by Government. This, it is urged, would compel its adoption by Great Britain, which is not the only point upon which its advocates are mistaken.

The "Apatite Deposits of Canada" is the title of a paper read at the last meeting of the American Institute of Mining Engineers. It does not, as might be supposed, refer to the sawdust sandwiches and leathery steaks deposited before the patrons of Canadian restaurants, but to a species of rock found in the Dominion.

The next meeting of the American Institute of Mining Engineers will be held in Chicago, beginning Tuesday, May 27, and continuing until Friday evening.

Improvements in the methods of using gas have been comparatively few for several years, probably from the fact that there has been no healthy competition in the business of furnishing it. In the meantime, the electric light is making progress, but its use has not as yet decreased the consumption of gas to an appreciable effect, if at all. A few years more of progress in electric lighting will compel gas companies to bestir themselves to make the service of gas better and cheaper than it now is.

Universal and Combination Lathe Chucks.

BY FRED. J. MILLER.

The immortal Chordal once said that his own personal objection to the wire gauge was its existence, and, to judge from articles which have lately appeared in the AMERICAN MACHINIST, there are mechanics who have the same objections to universal and combination lathe chucks; yet there are many other mechanics who persist in doing pretty fair work with them, and considerable of it; and it is my belief that a lathe to be used for general purposes, especially tool work, cannot be considered well equipped without two combination chucks—one with the ordinary stepped jaws for the larger work, and the other with what is known as the "reverse jaw" for small work, hand tooling and finishing, and for drills, etc. And I think any good mechanic can prove that it is possible to so mount a chuck upon a lathe as that it will be sufficiently true for nine-tenths of his work, and for the other tenth it is certain that the universal piece of chalk will be of no avail as a substitute.

Most makers now-a-days grind the gripping surfaces and front faces of their chuck jaws, thus giving them the appearance of being very true.

But all is not gold that glitters, and all surfaces are not true that are ground, and I have yet to find the first chuck in which the working surfaces of the jaws, when strained up, were true with the recess at the back for the reception of the face-plate by which it is attached to the lathe; and until this is remedied no chuck can possibly be mounted true.

Some other causes of dissatisfaction with

chucks are that the screws act in one direction on one side of the sliding surfaces upon which the jaws move, while the resistance of the work held acts in the opposite direction, on the other side, and thus the jaws are strained "out of square," and so grip the work at its extreme inner end only, leaving the other end to wobble and run out of truth.

Then a good many of the reverse jaw chucks have V grooves cut in the gripping faces of the jaws, as shown at Fig. 1, which figure also shows why the ground surfaces on such chuck jaws are available for only one size of work, and that is the size corresponding to the radius at which the surfaces were ground. Anything larger is held by the outer corners, while anything smaller is held by the corners of the grooves, and, as many of these grooves are forged in roughly, and certainly none of them are ground true, it is evident that they effectually prevent chucking work true. There is probably no remedy for the groove difficulty, unless it be the killing of the groover.

By way of a contrast, I may mention a plan which was shown me by a man who was doing a good deal of small work on dental tools. He deepened and dovetailed the grooves, and fitted pieces of steel into them, letting the pieces project, as shown at Fig. 2. He left these pieces soft, and as often as he desired he ran a cut through them and made them true, and when they were all cut away renewed the pieces.

I tried to convince him that special chucks of various kinds could be made which would answer his purpose better, and he tried to convince me to the contrary. We both failed, and I give his "kink" for the benefit

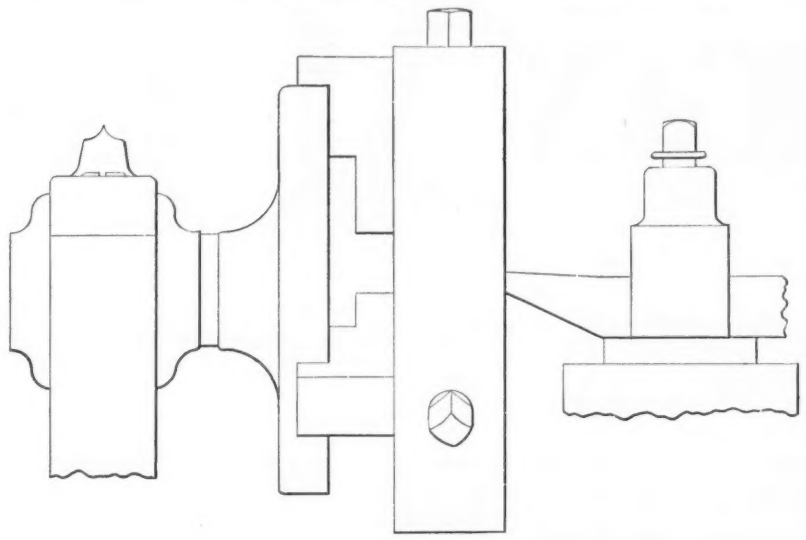


Fig.3

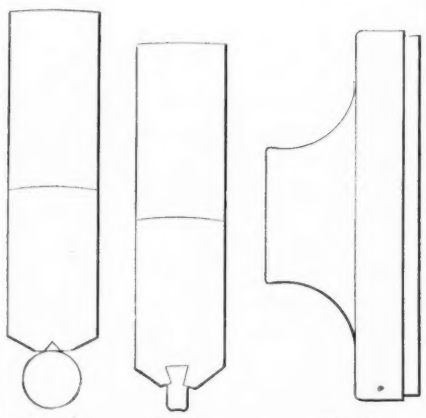


Fig.1

Fig.2

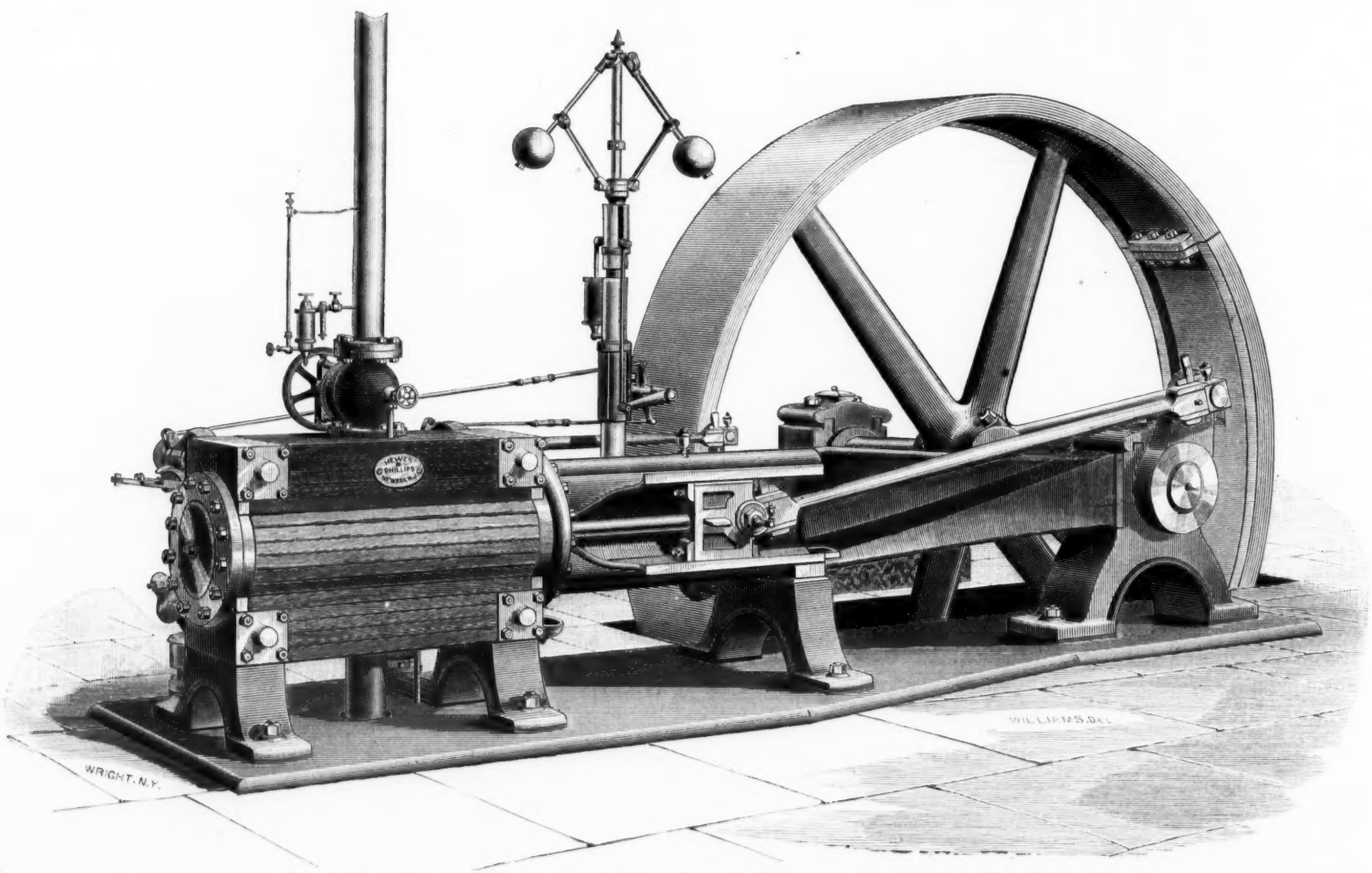
Fig.4

of those who may be disposed to agree with him.

Before fitting a chuck to a lathe, it should, if possible, be itself chucked, and the gripping surfaces of the jaws be ground, so that when they are screwed down hard on a piece of cylindrical metal they will clamp it equally hard along the entire length of the jaw. In order to make them do this, it will be found necessary to grind them slightly tapering, so as to form an acute angle with the face of the chuck. The required amount of this taper must be determined by trial, as the grinding proceeds. The next operation is to make the recess at the back, into which the face-plate is to be fitted, true with the gripping surfaces of the jaws when the chuck is strained up, and Fig. 3 shows how it may be done.

The jaws of the chuck are simply tightened on to something which is known to be true, and the recess turned out. It will be noticed that by this method the important parts of the chuck, viz.: the jaws and the part to which the face-plate is fitted are made precisely true with each other, and, moreover, it is done when the chuck is strained up exactly as when in use. In the case of a reverse jaw chuck having a hole through the center sufficiently large, it is probably better to put an arbor through the hole and close the jaws upon it; then the arbor may be driven upon the lathe centers while truing the recess.

The squares on the screws are generally numbered, and it is best when closing the jaws to commence with the wrench at No. 1, and go around the chuck in the order of the numbers until sufficiently tight; then, by observing the same order when chucking work, the chuck is put in the same condition respecting back lash as it was when trued up. It is a good plan, also, to leave a part of the face-plate larger than that part which fits the chuck, as shown at Fig. 4. Then, when the chuck wears out of true, the recess may be turned out as before, and the plate refitted to the chuck. I have seen combination and universal chucks give good satisfaction on first-class work after being treated in this way; but, of course, much depends upon the choice of chucks, and in this as in many other matters it is not wise to conclude that the oldest and best-known is necessarily the best.



FRONT VIEW OF CORLISS ENGINE AS BUILT BY HEWES & PHILLIPS IRON WORKS. (See Page 1.)

The Travelers' Insurance Company of Hartford have been enterprising enough to send out a special press edition of the official engraving of the French Statue of Liberty upon its American pedestal, as it will appear in New York Harbor when completed next year. We have framed the copy sent us and hung it up in our office.

The Result of Imperfect Setting of Horizontal Tubular Boilers.

QUESTIONS AND ANSWERS IN REGARD TO THE PROPER METHOD OF SETTING.

By George Marshall.

A correspondent gives me the following account of the setting of two boilers (presumably under his care), and asks the questions hereafter appended. I have thought the matter of sufficient importance to give other readers of the American Machinist the benefit of his experience, as there may be some who have boilers set on the same principle, and with corresponding results:

"We had two boilers made in Chicago in 1875, of the following dimensions: 54″ diameter, 14′ long, 48 3½″ tubes in each boiler. Best U. S. C. H. iron was used in their construction; plates, $\frac{5}{16}$″; heads, ½″. The boilers have each one steam dome 35″x35″, also mud drums 16″ diameter. They are set in the following manner: Grates are 16″ from boilers; furnaces are 4′ 8′x4′ 8″; bridge wall is 20″ deep, 12″ from boiler; back of bridge wall the space is 30 inches, and extends back to rear walls; side walls are 18″, with 2″ air space between the courses of brick. The heat passes under boiler, returns through tubes and passes over top of boilers to stack through flue 24″ from top of boiler to brick covering. The top of the boiler has no protection of any kind, and heat comes in contact with the boiler at this point. Our boilers have bagged down over grates three separate times, and we have been obliged to have new fire sheets put in after four months' use. They are now nearly worthless, and will have to be taken out. What I wish to find out is this:

1st. Are not these boilers imperfectly set?

2d. Should not the tops of boilers be protected against heat where no water comes in contact with the iron?

3d. Are not the grates too near the boilers?

"I forgot to state that we use these boilers to run a Brown automatic engine, 16′x42″, with steam at 70 lbs. boiler pressure. The boilers are never crowded in the least. We burn soft coal, slack, shavings and sawdust. Boilers are cleaned every Sunday, and flues cleaned every morning before starting engine. Water is pumped in hot at all times through

'Stillwell' heater, and every precaution has been taken to prevent cold air coming in contact with fire sheets, but all to no purpose."

A perusal of the foregoing plain, comprehensive and intelligent statement, is sufficient to convince any one of experience in the care and management of boilers that the trouble arises not from neglect or lack of intelligence on the part of the writer, but must be caused entirely from the setting. The only wonder to me was, that boilers were set on this plan as recently as 1875, as the placing of the grates so near the shell was condemned, and I supposed abolished, previous to that date. Still there is great diversity of opinion among experts as to the proper distance allowable, and in fact there is no real unanimity among boiler builders on this point. The question to my mind is one that requires more than ordinary attention, from the simple fact that the difference in fuel will necessitate a greater or lesser distance in proportion to the volume of gases contained in the fuel. A space sufficient for anthracite coal would not be sufficient for bituminous coal, nor for the mixture referred to in the letter.

I have no hesitation in condemning the practice of carrying a flue over the top of any boiler, as the risk is too great in proportion to the expected benefits, so I condemned the top flue in my reply to the first question. My statement in regard to the second question was, that a protection was needed to prevent loss of heat from radiation or condensation, and I recommended a covering of light ashes, which, in all cases, is sufficient protection, and they are inexpensive and can easily be removed by the engineer or inspector, should there be any evidence of a leak in the top of shell. Replying to the third question propounded, I stated that opinions differed in regard to what constituted the proper distance between shell and grates, yet I had no hesitation in saying that in this case the grates were entirely too close for economy of fuel.

In the winter of '82 I was sent to a large manufacturing concern in Oswego county, to examine a battery of six boilers which were reported as being insufficient to heat the premises and run the dye house. The boilers were 5′ diameter, 15′ long, and had 90 tubes 3″ diameter in each. I found the grates placed 18″ from shell, and also found that *each boiler had an outlet from dome through a* 4″ *pipe connecting with a* 4″ *main horizontal pipe* supplying dye house and lateral branches for steam heating. I suggested changing the grates from 18″ to 26″, and the substitution of a larger pipe or receiving domes for the general distribution of steam. These suggestions were afterward adopted, with an economy of 40 per cent. in fuel. Previous to the adoption of the suggestions the firemen were constantly employed in shoveling coal into the furnaces, and as there was a good draft in the chimneys it burned freely, yet without supplying the wants of the different departments, so that part of the works were run in the day time and part at night, in order to maintain a proper temperature for the comfort of the operators. In addition to the saving of fuel, during the past winter one boiler was laid off for repairs and the want of it not felt.

The space back of bridge wall referred to as being 30″ is, to my mind, excessive, although I know many engineers claim the utility of a combustion chamber at that point. Replying to my correspondent, I gave him the practice of the Jarvis Furnace Company in such cases, which is to carry the back ground line on a level, or nearly so, with the bridge wall proper. As the Hartford Boiler Inspection and Insurance Company are interested in the safety of steam boilers insured by them, I also quoted their practice in corroboration of my own ideas, deeming them good authority on such subjects.

My own practice when a boiler inspector was, to insist on the removal of the arch flue over the top of boiler in every case where found, and invariably dangerous defects would be visible on removal of the arch.

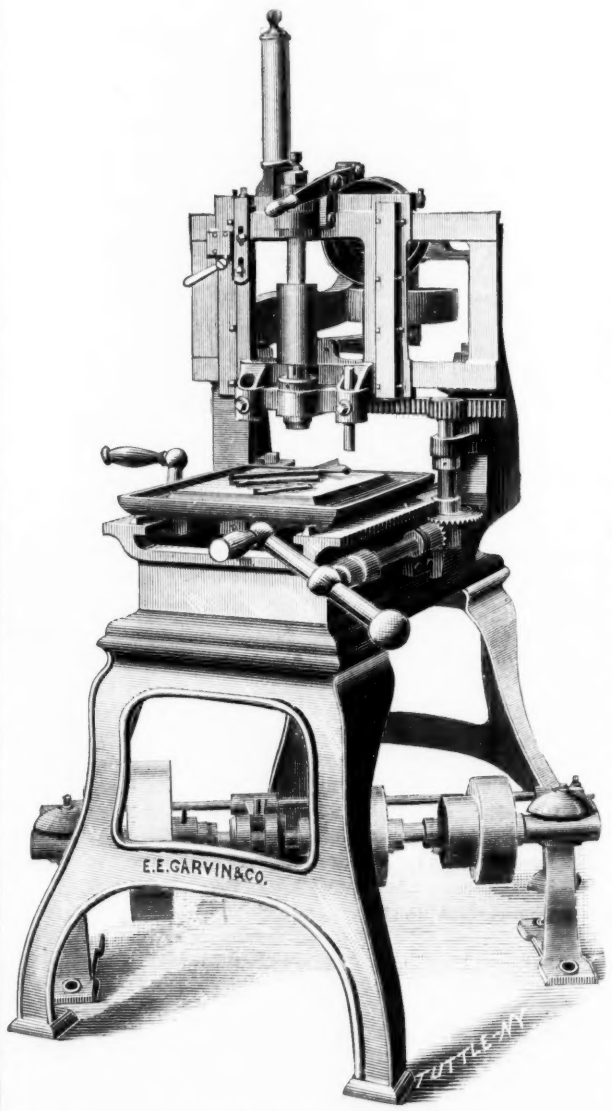
There was other information which should have been furnished by my correspondent, namely, the point at which the feed water was introduced, and how the boilers were supported, whether by suspension braces or brackets resting on side walls. Enough, however, was given to convince an intelligent reader of the fact that the setting was defective, and the durability of the boiler decreased 50 per cent. by the plan adopted.

The subject shows the necessity on the part of steam users of better understanding their wants in every case of this kind, and thus preventing a recurrence of the useless expense and loss of time following the results referred to.

In a late article I gave the names and nature of the different brands of iron used by boiler makers in the manufacture of steam boilers. I forgot to say, however, that C. H. No. 1 is a brand still used by Western millmen to denote "shell" quality, and is probably the brand referred to as "Best U. S. C. H. iron." The C. H. No. 1 letters alone are intended for deception, and never should be used. They represent merely a piracy of the letters stamped on plate iron, conveying the meaning of "Charcoal Hammered No. 1 iron," but the word "Flange," as a rule, accompanies the latter brand; in the former it is intentionally omitted, with what object your readers can best judge. While it is evident to my mind that flange iron of the best quality, under the same circumstances, would have acted in a similar manner, the fact remains the same that steam users, as a rule, are far too ignorant, and far too trusting as regards the purchase and maufacture of such a very important article as a steam boiler. This is not, however, a subject of astonishment when it is known that engineers of ability and distinction are equally ignorant of the fact that two such similar brands of such very different meanings ever were used, and still are used by many boiler builders.

The fact that the grates were placed as close to shell as described in my correspondent's letter is another evidence of the non-progressive policy pursued by boiler builders, and is also an evidence that boiler builders do not read enough on mechanical and scientific subjects to keep up with the progress of the age. The patterns for the cast fronts of these boilers had probably been made at a time when the custom was to keep the fire close to the boiler, and as no complaints had been made by parties using them, they were considered good enough for the present and future, regardless of the fact that the old theory of close fires had long ago been exploded, and attention bestowed by scientific minds to the fact that more combustion room was necessary. The outlay of a few dollars in the alteration of the old patterns would have resulted in the saving of the expense of fire sheets, added to the durability of the boilers, and given the boiler builder a better reputation. The new boilers, when put in, will probably have the benefit of modern views, and modern practice and increased durability will naturally follow the improvement.

The *Mexican Financier* draws attention to the fact that numerous complaints are made of damage to American machinery arriving in Mexico by the water routes. American machine makers have suffered in reputation in the past by the rough handling of their products by parties connected with the water routes, who seemed interested in discrediting the character of goods sent from the United States. A perfect remedy for this evil is now in the hands of shippers since the railroad connection was completed. By sending machinery by rail, our dealers are likely to secure safety and prompt delivery, besides taking carrying trade away from parties who have labored assiduously to injure the reputation of our goods.



NEW PROFILING MACHINE.

New Profiling Machine.

The engraving on this page shows an improved single spindle profiling machine, just brought out by E. E. Garvin & Co., 139 and 141 Centre Street, New York.

Compared with the regular two-spindle style of edge-milling machine, it occupies but little more than half the floor space, being rather more compact on account of dispensing with the long drum, and in place of that, driving the spindle from a single pulley, which keeps an equal belt tension, as it is held at the end of a radial arm, which preserves a constant center distance between that and the center line of cutter spindle.

A special feature upon this machine is that two former-pins are used, fixed upon the line of and equally distant from the spindle center, allowing thereby a superior mode of placing the former and the work to be milled. When the former is to be cut from a sample piece, no resetting of the former is called for, as it is used in the exact position that it was made, and the work is milled upon the spot where the sample was fixed in making the former.

The four motions of traverse necessary are accomplished by rack and pinion movements (adjustable), controlled from front end of machine by two large ball handles.

Four changes of speed are obtainable by means of a cone of two faces and a counter with a novel and efficient clutch motion, allowing two speeds of shaft.

Porter's Adjustable Pipe Wrench.

In this wrench a straight shank is provided with teeth at its inner end, which forms a fixed jaw. To this jaw a metallic strap is fitted, in which is the fulcrum for the concave toothed movable jaw. This movable jaw has an extended end, against which the spring shown operates to keep the jaw in contact with the piece being turned.

This wrench is intended for use on pipe, studs or nuts, and is very simple in its construction, without screw threads or nuts to wear out. It is manufactured by the Revolution Tool Company, Woonsocket, Rhode Island.

ADJUSTABLE PIPE WRENCH.

Greely Relief Steamer Alert.

After crowding through numerous workmen and climbing over accumulations of supplies in the form of bales, boxes, barrels and every shape of package, a representative of the AMERICAN MACHINIST the other day succeeded in reaching the engine room of the Alert, where he found engineer Nauman creeping into one of the boiler furnaces. Mr. Nauman, who will have charge of the machinery of the Alert during the search for the Greely party, is a passed assistant engineer of the Navy and he began his duties on the Alert by personally inspecting every detail of the machinery that will be under his charge under circumstances where failure might prove an extremely serious matter.

The engines of the Alert are very compact, but we think a few inexpensive changes would enable them to be handled more conveniently for the engineer in charge. The engines are horizontal, that type having been selected as being most easily placed below the water line, the vessel having been built as a sloop of war. The cylinders are, high pressure 28 inches, and low pressure 48 inches diameter, the stroke of both being 17½ inches. The valves are common slides operated by link motion. The condenser is so arranged that it can readily be changed from surface to jet operation. A small rotary engine is used to work the circulating pump. There are only two boilers with two furnaces each for supplying steam to the engines, and for the heating and thawing out pipes which extend through a great part of the ship. The boilers are tested at 120 pounds and carry 60 pounds of steam. Four different sizes of plates have been used in their construction, and a spare plate of each kind is carried. Spare pieces of the greater part of the machinery are carried to meet the necessities of any accident.

The engineering crew of the Alert consists of two engineers, besides the chief, six firemen and two coal trimmers. This keeps true to the prevailing practice of our Navy, which habitually under-mans the engine room. Any merchant vessel of the same size would have engineers enough to attend the engines without the chief needing to keep a regular watch, especially where there is so much work attending to condensers and heating apparatus as there is on this vessel. We think that a serious mistake has been made in not at least adding one more engineer to this crew, for serious consequences might ensue from the sickness or disability of one or more of the engineers.

Experiments have for some time been made in Belgium for preserving wood by exhausting the air from the pores and filling them with liquid gutta-percha. The gutta-percha is liquefied by mixing it with paraffine and subjecting to heat. After it is introduced into the pores it hardens as it becomes cold.

Elements and Manufacture of Foundry Facings.

BY THOS. D. WEST.

FIRST PAPER.

Foundry blackings have always been more or less a bone of contention between the user and manufacturer, the former complaining of inferior goods, and the latter of ignorance in their use. There is no question but both are often right. Blacking can be of an inferior quality, and can also be ignorantly used. There are two things that stand in the way of investigating the qualities of blacking said to be poor. The first is, not knowing of what material it is made; the second, the moulder's readiness to find any excuse for rough-skinned or scabbed castings. To blame that which none are well enough informed about to defend leaves a clear field.

The manufacturer of blacking is most frequently censured for that used on heavy work. One reason for this is in the high quality required for such work, and the fact that the moulder is called upon to make mixtures of blackings before he can apply it to the mould. For light work, or that where the blacking is used as received from the manufacturer, he can be more justly blamed for poor results. Again, the moulder is called upon to make a wash for dry sand or loam work. In this class of work the manufacturer receives much unjust censure. In "American Foundry Practice" it is fully shown wherein much lies with the moulder in mixing blacking and in putting it on his mould, in order to produce smooth skinned castings.

Blackings are often condemned that in reality are too good. Almost any blacking will cause trouble if not understandingly used. One complaint often heard is that of blacking sticking when being printed or sleeked. Another is that of its washing or rolling up when pouring the mould. This last complaint is in reality a serious one, and one which the moulder is justified in making. A blacking which will wash lacks cohesion, caused either by too coarse grinding or the want of a bond. The materials chiefly used for binding or preventing blackings from washing, are leads and other minerals, and clays. Our heavy blackings are principally composed of carbon, coke, and anthracite, with the above-named bonds. The finer ground blackings are, the more cohesion and body they will possess, which makes them a better wash and dust for moulds. For a dust, fine ground blackings are generally more or less sticky. In fact, it is generally an evidence of good quality and mixture to have blacking sticky. A blacking that will stick while being sleeked or printed, can generally be relied upon to "peel" well. I know moulders dislike to work with sticky blackings, and condemn them. Of course, what the moulder wants is a blacking that will "peel" well, and that will not stick. To thoroughly combine these two qualities in rich or heavy blackings is one of the things facing makers seldom accomplish. To assist the sleeking and printing of sticky blackings, charcoal is extensively used. In stove foundries the moulders generally have two bags, one containing the peeling or heavy blacking, the other the charcoal. The heavy is first shaken on, then the charcoal. In machinery foundries, charcoal is not so generally used as in stove plate shops; were it more used on the former work, it is safe to say less complaint would be heard. Not only is charcoal good to assist bag dust sleeking, but it also is an excellent article to have on hand for mixing with wet blacking. It frequently happens that blacking contains substances of a very close or non-porous nature. These will often cause "blacking scabs." The introduction of a small proportion of charcoal will often remedy this, as the particles, being very light and porous, assist the gases of the heavier blacking to escape more freely.

The use of blacking is simply to coat the surfaces of the mould with graphite or carbon, to prevent the heat of liquid iron from fusing or eating into the sand. Moulding sands are composed more or less of silica, together with smaller quantities of potassa, lime, magnesia, oxide of iron, etc. The potassa, lime, magnesia, and oxide of iron are the parts that fuse. They combine with the silica to form silicates, or a kind of glass, which, upon heavy castings, may form a scale from $\frac{1}{32}$" up to $\frac{1}{2}$" thick, where the sand is not thoroughly protected with a coat of carbon, or, commonly speaking, blacking. All black leads consist chiefly of carbon, the other ingredients being alumina, silica, lime, iron, etc. The freer leads are of these latter ingredients, the more intense heat will they stand before they will fuse. There are some leads, it is said, that no heat will fuse. As all good blackings are composed more or less of graphite, or, commonly speaking, leads, the reader will readily perceive the cause of their preventing liquid iron from eating into the surface sand of moulds, and why they provide for smooth skinned castings. Of course, it is to be understood most blackings are but partly composed of leads. The more lead blackings contain, the better they are for peeling. This applies to loam as well as to green sand moulds. Consequently the larger per cent. of graphite or lead blackings contain, the better. But as these blackings are expensive in proportion to the amount of graphite they contain, and as many foundrymen overlook quality to buy cheaply, it offers a premium to the manufacturer to use cheap materials in order to make cheap prices. The cheaper blackings are composed principally of Lehigh, coke, or gashouse carbons, with additions of various minerals, and contain little or no leads. Lehigh, coke, and carbons are seldom ground pure. The particles, when powdered, will lack cohesion, and therefore would be apt to float or wash when pouring green sand moulds; therefore the necessity of mixing in the various kinds of minerals or clays to obtain the required cohesion.

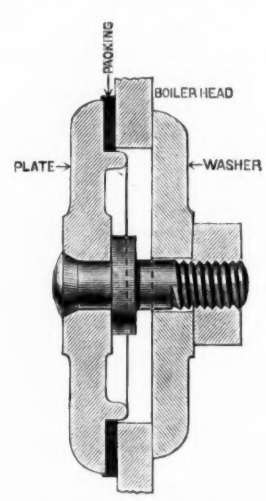
In order to gain an insight into the manufacture of blackings, I obtained the consent of R. J. Hayes to visit the Cleveland Mills, and was not a little surprised at the amount of machinery and care required to turn out modern blacking. It would be a tedious job, and tiresome to the reader, to go into a minute description of the different crushers, pulverizing machinery, etc., required to reduce the carbons, coke, Lehigh, leads, etc., which go to make up to a great extent our foundry blackings. The machinery is to some extent similar to that of flouring mills. The materials being hard, they are required to pass through several reduction machines before they are fed to the mills, after which they pass into the bolting reels, where they are sifted through silk cloth, containing, it is said, about 29,000 holes to the square inch. All particles too coarse to pass through the cloth are let out at the end of the reels, and returned to the grinders. A facing mill, so far as dust is concerned, is probably the dirtiest shop to be found. When in full operation, one can hardly breathe or see anything but dust. The least generator of dust is that commonly called sea-coal facing. The making of this blacking requires the least labor and manipulation of any with which mills deal, as it is simply the product of a bituminous, or, as it is sometimes called, stone coal. A great many take it for granted that because this blacking is called sea coal, it is in some way a sea product. Sea coal is not what its name implies. It acquired this name many years ago, when introduced as a fuel in England, being carried by sea to London, and this misnomer still clings to it.

One of the latest patented inventions is a machine for the cleaning and blacking of boots. Machinery has long been called upon to aid the barber, and now the bootblack is going to have the opportunity to invest his saved pennies in a machine that will grab hold of a boot and polish it off sooner than the boot black could get on his knees to operate on the old plan.

In Birmingham, England, a plan for supplying compressed air from a central station is being worked up. It is to be used in the ordinary steam engines, and it is claimed that it will serve as a valuable auxiliary in the ventilation of buildings.

Closing Up Tube Holes.

The following excellent plan for closing up holes in tube sheets we extract from the *Locomotive*, published by the Hartford Boiler Insurance Company: "We have often pointed out, in the columns of the *Locomotive*, the objections to crowding too many tubes into the ordinary type of boiler, in order to gain nominal heating surface. One objection to this practice is this: With hard or muddy water there is great liability of choking up the passages between the tubes, and between the tubes and shell near the back end to such an extent that there is great danger of burning the plates. This has occurred in many cases that we have been connected with, and we have often had to remove some of the tubes to clean the boiler. To replace the tubes in such cases would simply be paying out money to produce a repetition of the trouble. Instead of doing so, we leave them out, and stop up the holes with the device



shown in the accompanying cut. A small plate, similar to an ordinary hand-hole plate, but circular in section, is put on the inside of the head, and packed with rubber. A washer is applied on the outside, and the whole tightened up exactly like a hand-hole plate. No difficulty need be experienced with the device, and it may be removed at any time to facilitate cleaning or repairs. In putting the plate on, it will, of course, be necessary to pass it through the hand-hole in the boiler-head."

Work on the Panama Canal.

Mr. A. B. Stetson, Superintendent of the Pound Manufacturing Company, Lockport, N. Y., has just returned from Panama, where he has been residing during the last seven months superintending the erecting of dredging machinery made by his firm for the Panama Canal Company. From Mr. Stetson, who spent an afternoon in this office, we obtained interesting information regarding the progress of the stupendous work of cutting the Panama Canal.

The work of constructing the canal is of much greater magnitude than even the engineering world understand. For seven miles on the Panama end, and for three miles at the Colon end the width of the canal is 676 feet; while for the middle, 17 miles, it is 338 feet wide, the whole having a uniform depth of 30 feet. In certain parts, the physical features of the country entail tremendously expensive excavations. The Chagres river bed is crossed several times, and provision must be made to control the waters of that river, which is a great undertaking in itself, for the river is subject to huge floods during the rainy season, and this water must be kept out of the canal. The line of the canal crosses a hill which is 350 feet high, entailing a cutting of that depth for over three miles. As the hill is all soft material, the top of the cutting is surveyed 1600 feet wide, and it is doubtful if that slope will be enough to prevent bad earth slides.

A great deal of expensive preliminary work has been done connected with the canal, substantial dwellings and hospitals having been erected. The work has been divided into twelve divisions, and excavating is now proceeding in every division. There are about 20,000 men engaged on the works, most of them being Jamaica negroes, and they are miserably inferior laborers. A number of natives are also at work, and they are a shade better than the importations from Jamaica, still they are far from being industrious.

Two of the dredging machines made by the Pound Manufacturing Company have been at work for several months, each of them taking out 1300 cubic yards daily. Two more machines are nearly ready. The heaviest machines on the works are the bucket dredges belonging to the Panama Canal Excavating Company, of New York. One of these dredgers, which was built at San Francisco, has been at work for some time, taking out as much as 7800 cubic yards daily. Two more of these huge machines have been built on the Delaware and sent out. The second to arrive was burned by accident, but the third one is now ready for work. These machines work admirably in the earth work for which they were built, but several attempts have been made to apply them to the excavation of rock, boulders and tree stump covered ground, and there they do not work well.

French interests are all powerful on the Panama Canal Works, all the men doing intellectual and skilled labor employed by the company being French. Machinery that has not been made in France is condemned from the beginning, and every effort is made to discredit its working. American, English and Belgian machinery all fare badly in the hands of these French operators, who are determined to see no great merit in any foreign made article. They have succeeded in damaging the reputation of every foreign made machine they have handled, except the American locomotive. The American locomotive is so well adapted to withstand the rough usage of rude construction work, that the French engines engaged in the same service were helpless in comparison. The French engineer would abuse and revile the American locomotive without limit, but it kept to work and held the track day by day, while its French rival was in the ditch or in the shop, so the officers of the company were reluctantly compelled to admit that the American locomotive was the best for their work.

The Panama Canal Company have now got entire control of the Panama Railway, and they are improving the condition of the road bed, which was in extreme bad order. Over 400 men are working on the 27 miles of track, putting down new rails and ties, also draining the road bed.

There does not seem to be much likelihood of the present company finishing the canal. Of the $114,000,000 originally subscribed for, to complete the work, two-thirds have already been spent, and the real work of excavating the canal has hardly been commenced. The total amount of material to be moved is estimated in the neighborhood of 140 millions cubic yards. Not more than 5½ million yards have been moved and the greater amount of that has been confined to earth work and dredging. More than half of the excavation is rock, and that has hardly been touched yet. The farther this work proceeds, the magnitude of the enterprise appears the greater. Extraordinary exertion will be needed to finish the work within ten years instead of four, the time now spoken of.

LETTERS FROM PRACTICAL MEN.

The Throw of Eccentrics.

Editor American Machinist:

I respectfully take exception to your conclusions on the subject of "throw" of eccentrics in your issue of May 3d. In a search to discover the more general usage of the word some time since, I found that the majority of American authors call the throw the distance between center of eccentric and center of shaft, or the half travel; while the favorite English meaning seems to be—throw equal to travel. In Knight's "American Mechanical Dictionary," throw is defined as "the radial reach of a crank, eccentric or cam."

It is customary in naval engine work to call the piece connecting crank-pin and shaft the "crank throw." We ordinarily speak of the length of a crank, meaning the length from center of shaft to center of pin—not twice that, or the length of stroke. Hence it would seem that, as an eccentric is but an exaggerated form of crank, it would be more logical to term the throw the length of the equivalent crank arm or the half travel.

A. T. W.

[We have no doubt but our correspondent is correct in saying that the custom among those engaged on naval work is to call the radial reach of a crank, or eccentric its throw. But in the majority of American shops the whole linear travel of an eccentric is called its throw. So far as we can make out our mechanical writers are pretty evenly divided in their definitions of the subject.]

A Complaint About Lubricating Oil.

Editor American Machinist:

Reading in some of your recent issues letters from parties who have been deceived with a lubricating mixture, leads me to say that there is a good deal more of the lubricating humbug that has never been exposed. It makes us sick to see an oil fiend come into the shop. A great deal of the oil you get now is nothing but benzine and rosin, and looks very nice while in the sample bottle. In talking, a few days ago, with one of those oil men, I put a drop or two of good lard oil on the bench alongside the same amount of his oil, and, while we were discussing the merits of the oils, I happened to look at the oils on the bench. "Now," said I, "where is your oil?" It was gone—all evaporated—and there was nothing left, not even a grease spot; while the good oil had not changed its appearance.

We have been so annoyed with bad oil that we hardly know what to do. We might just as well put so much varnish on our machinery as a lubricant. Have any of your numerous readers such a thing as an apparatus for testing the wearing qualities of oils? If so, we would like to communicate with them. As it is now, it requires a great deal of our time to take down one lathe after another, clean them and put cogs in the gears to replace those broken. You may infer that we buy cheap oil; it is not so. It makes no difference how much we pay for it, it is hard to get a pure article of oil.

BENJ. F. HETHERINGTON.

Indianapolis, Ind.

Steam Pipe and Throttle Valve.

Editor American Machinist:

Seeing a discussion going on in the AMERICAN MACHINIST in regard to the size of steam pipes that will supply an engine, I have concluded to contribute my mite.

Somewhere in the long-ago I had charge of an engine with a 10″×15″ cylinder running 250 revolutions per minute; boiler pressure 100 lbs., when I could get it. I was not running that engine long before I found the boiler was entirely too small to supply the engine, to do the work that was expected of it, so I had to take every advantage possible, and I can assure you I tried many experiments with that machine; one of them I will give you.

The throttle valve was the ordinary globe type. Instead of opening the valve full I just gave the wheel one-half a turn, so the valve could not have been more than one-eighth of an inch from the seat. The engine did the work just as well as with a full throttle.

Now, if these would let steam enough go through that opening, what is the use of such large steam pipes? It seems to me that this is a case where practice rather has the advantage over theory. As far as I am concerned I have found several instances where practice has completely knocked theory all to pieces.

A. BRUNSON.

Laying Out Link Motion.

BY J. G. A. MEYER.

THIRD PAPER.

PROBLEM 5—FIG. 7.

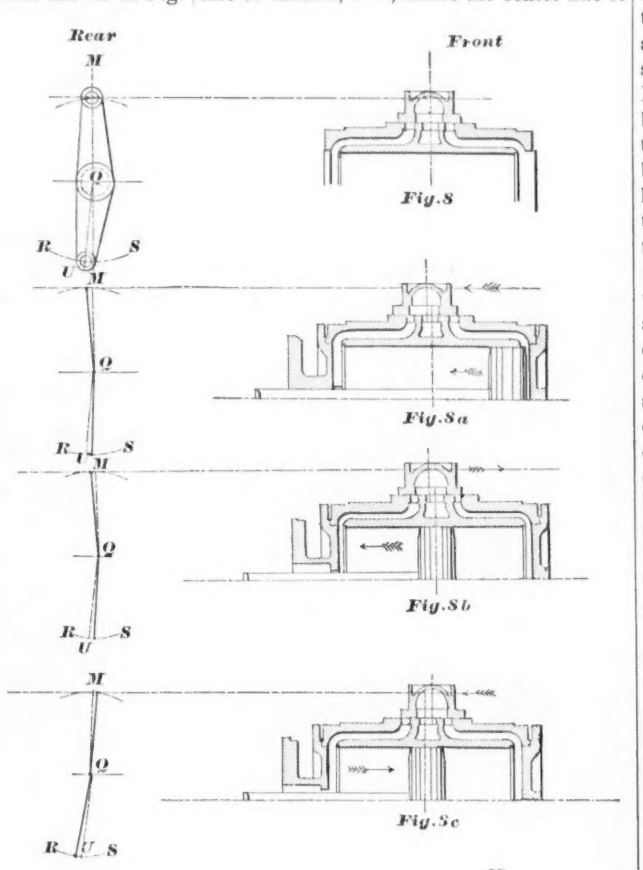
To find the position of the center of saddle pin: For this problem we again call to our aid the paper template shown in Fig. 6 *b*, (May 17.) We have already seen in problem 4 that the center of saddle pin will be located on the line, *e e*, drawn on this template; it now only remains to determine the distance of this point from the link arc $c_3\ c_4$.

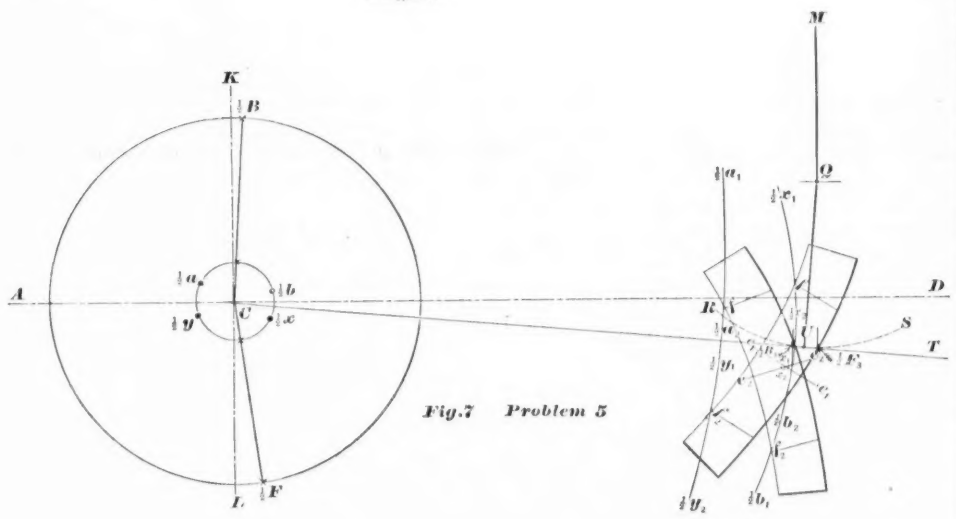
Since the inequality between the crank angle *W* and W_1, Fig. 5, becomes the greatest when the crank stands at half stroke, it is of the utmost importance to find such a position for the center of saddle pin, that equal portions of steam will be admitted alternately when the crank stands at half stroke. Or, in other words, the admittance of steam must cease at the moment that the piston has completed one-half stroke.

Let us commence this problem as we began the others, namely: Through the center of axle *C*, Fig. 7, draw the horizontal line *A D*, also the vertical line *L K*. Find the position of crank at half stroke as shown in Fig. 3. Next find the position of center line of motion *C T*, and position of rocker as shown in Fig. 4. Find the relative position of eccentrics and crank when at half stroke, as shown in Fig. 5. Now, with a radius equal to the correct length of eccentric rods, previously determined (shown in Fig. 6), describe from the point $\frac{1}{2}\ x$, as a center the arc $\frac{1}{2}\ x_1\ \frac{1}{2}\ x_2$; also with the point $\frac{1}{2}\ y$ as a center, and with the same radius, the arc $\frac{1}{2}\ y_1\ \frac{1}{2}\ y_2$. Again from the point $\frac{1}{2}\ a$ as a center describe the arc $\frac{1}{2}\ a_1\ \frac{1}{2}\ a_2$; also with the point $\frac{1}{2}\ b$ as a center describe the arc $\frac{1}{2}\ b_1\ \frac{1}{2}\ b_2$ using the length of eccentric rods as a radius for all the arcs.

When the center of the forward eccentric is at $\frac{1}{2}\ x$, the forward eccentric rod pin will be located in the arc $\frac{1}{2}\ x_1\ \frac{1}{2}\ x_2$. When the center of the forward eccentric is at $\frac{1}{2}\ a$, the forward eccentric rod pin will be located in the arc $\frac{1}{2}\ a_1\ \frac{1}{2}\ a_2$. When the backward eccentric is at $\frac{1}{2}\ y$, its eccentric rod pin will be located in the arc $\frac{1}{2}\ y_1\ \frac{1}{2}\ y_2$. When the center of the backward eccentric is at $\frac{1}{2}\ b$, the eccentric rod pin will be located in the arc $\frac{1}{2}\ b_1\ \frac{1}{2}\ b_2$.

The next step is to find the relative position of the lower rocker arm pin when steam is cut off at half stroke.





In Fig. 8 we have placed the slide valve centrally over the ports, that is, it laps over each steam port an equal amount, namely $\frac{3}{4}$ of an inch, which is equal to the lap. In this position of the valve, the center line of the upper rocker arm will stand perpendicular to the line drawn parallel to the valve face, and the center line of the lower rocker arm will stand perpendicular to the center line of motion, *C T*, hence the center line of upper rocker arm *M Q* in Fig. 8 will coincide with the line *M Q* in Fig. 7, and the center of lower arm *Q U* in Fig. 8 will coincide with the line *Q U* in Fig. 7.

Now let us follow the relative movement of the valve and piston. We find that when the piston commences its backward motion the valve moves in the same direction as shown by the arrow points in Fig. 8 *a*, and during the time that the piston is completing the half stroke, the valve has finished its full travel backward and commenced moving forward as indicated by the arrow points, Fig. 8 *b*, and at the time that the piston stands exactly at half stroke, the forward edge of the valve is just closing the forward steam port, and consequently cutting off steam at half stroke when the piston is moving backward. From this we see that when the piston has completed the half stroke when moving backward the center of the valve will be a little in the rear of the center of exhaust port, the distance between the center of valve and the center of exhaust port being $\frac{3}{4}$ of an inch, the amount of the lap; the upper rocker pin will stand $\frac{3}{4}$ of an inch behind the line *M Q*, and the lower rocker arm pin will be $\frac{3}{4}$ of an inch in front of the line *Q U*, as shown in Fig. 8 *b*. We therefore draw in Fig. 7 a straight line parallel to *Q U*, and $\frac{3}{4}$ of an inch in front of it; this line will intersect the arc *R S* in the point $\frac{1}{2}\ F_3$, and this point is the position of the center of lower rocker arm pin when the crank stands at $\frac{1}{2}\ F$ and steam cut off at half stroke. Let the piston complete its backward stroke, and then commence moving forward towards half stroke, as shown by the arrow point, Fig. 8 *c*. During this time the valve has completed its full travel forward and commenced traveling backward as indicated by the arrow point, Fig. 8 *c*, and when the piston stands exactly at half stroke, the rear edge of the valve is just closing the rear steam port, and consequently cutting off steam at half stroke when the piston is moving forward. In this position the center line of the valve will be $\frac{3}{4}$ of an inch in front of the center of exhaust, the center of the upper rocker arm pin will be $\frac{3}{4}$ of an inch in front of the line *M Q*, and lower rocker pin $\frac{3}{4}$ of an inch in the rear of the line *Q U*, as shown in Fig. 8 *c*. We, therefore, draw in Fig. 7 a line parallel to *Q U*, and $\frac{3}{4}$ of an inch behind it; this line will intersect the arc *R S* in the point $\frac{1}{2}\ B_3$, and this point will be the position of the center of lower rocker arm pin when the crank stands at $\frac{1}{2}\ B$ and steam cut off at half stroke. Now, remember that when the crank stands at $\frac{1}{2}\ F$, Fig. 7, the forward eccentric will be at $\frac{1}{2}\ x$, and the backward eccentric at $\frac{1}{2}\ y$; and if the link is raised or lowered while the eccentrics remain at $\frac{1}{2}\ x$ and $\frac{1}{2}\ y$, the forward eccentric rod pin will move in the arc $\frac{1}{2}\ x_1\ \frac{1}{2}\ x_2$, and the backward eccentric rod pin will move in the arc $\frac{1}{2}\ y_1\ \frac{1}{2}\ y_2$.

Let us now find the position of link when steam is cut off at half-stroke at either end of the cylinder.

The points $\frac{1}{2}\ F_3$ and $\frac{1}{2}\ B_3$ in Fig. 7 being located, place the paper template on the drawing so that the point *f* will lie in the arc $x_1\ x_2$, and the point f_2 in the arc $y_1\ y_2$, and the link arc $c_3\ c_4$ just touching the point $\frac{1}{2}\ F_3$. While the template is in this position, draw on the paper along the edge $c_3\ c_4$ a portion of the link arc, and mark the position that the line *e e* occupied, so that when the template is removed the line $e_1\ e_1$ can be drawn on the paper to represent the line *e e* of the template. Next place the template so that the point *f* will lie in the arc $\frac{1}{2}\ a_1\ \frac{1}{2}\ a_2$, the point f_2 in the arc $\frac{1}{2}\ b_1\ \frac{1}{2}\ b_2$, and the link arc $c_3\ c_4$ just touching the point $\frac{1}{2}\ B_3$; and while in this position, draw part of the link arc $c_3\ c_4$ on the paper, mark the position that the line *e e* occupied, and after the template is removed draw the line $e_2\ e_2$ on the paper, to represent the line *e e* of the template. Now find by trial a point x_1 on the line $e_1 e_1$, and another point x_2 on the line $e_2\ e_2$, so that the distances of these points from their link arcs are equal, and that a straight line drawn through them will be parallel to the center line of motion.

The distance from x_1 to the link arc—or, which is the same thing, the distance from the point x_2 to the link arc—will be the correct distance between the center of saddle-pin and the link arc $c_1\ c_2$, Fig. 6*a*. Or, in other words, the position of the point x_1 or x_2 Fig. 7 will indicate the proper position of the point of suspension on the link. For future reference let us mark this point of suspension on the template, and indicate it by *X*, Fig. 6 *b*.

The Massachusetts Institute of Technology, Boston, announces that entrance examinations to its courses in civil, mechanical, mining and eleectrical engineering, architecture, chemistry, physics and natural history, will be held at Boston, Washington, Cincinnati, St. Louis, Chicago and San Francisco on May 29 and 30, instead of May 2 and 30, as erroneously published.

According to our English exchanges, the iron business and allied trades are not in a satisfactory condition there, the product generally being greater than the demand warrants. Speaking of shipbuilding, *Engineering* says: "Every week there are further indications of the decline in shipbuilding, and as contracts are being finished, and no renewals come to hand, scores of workmen are being paid off, and are swelling the number who are out of employment on the banks of the northern rivers. It is matter for regret that there is every appearance that several of the shipyards will be entirely closed for want of orders unless some contracts are secured within the next three months. Engineers are not so active as they were a short time ago."

An English Locomotive Improvement Scheme.

A member of an English engineering society recently read a paper on "Improvements in Locomotive Engines," wherein some curious suggestions were made. The writer of the paper estimated that the highest average speed of locomotives is 45 miles an hour, and he wished to obtain the means of increasing this speed to an average of 60 miles an hour on standard gauge roads. He said the great obstacle to higher speeds was in the limited capacity of ordinary boilers to generate enough steam, and he could not see that this capacity could be greatly increased while the boiler had to be confined between the driving wheels. So that more room should be obtained for increased heating surface, he proposed separating the boiler from the engine, giving it the place now occupied by the tender, removing the coal and water to the carriage carrying the engine. By this means he believed the steam capacity of the boiler could be doubled without difficulty.

If we remember rightly, a scheme of this kind was put in practice in this country a good many years ago, under the name of the Harrison locomotive, and the arrangement proved the worst kind of a failure. English engineers will have to try some other plan to obtain greater steaming capacity in locomotives.

The Indicator Diagram.

By F. F. Hemenway.

DIAGRAMS FROM CYLINDERS SUPPLIED THROUGH SMALL STEAM PIPES.

The diagrams represented in Figs. 20 and 21 came into the writer's possession through the courtesy of Duncan Gilchrist, master mechanic at the works of the Cleveland Iron Mining Company, at Ishpeming, Mich. They are interesting from the fact that when they were taken the engines were supplied with steam through very small steam pipes. The engines are used for hoisting, and as relating to a matter of practical importance in connection with the use of hoisting engines, the following quotation from a private letter from Mr. Gilchrist is made:

"Our hoisting engines are piped in the following manner, and for the following reasons: A lever leads from the throttle valve to the brakesman at the drums, which allows him to start, stop or slow up at will, without the aid of an engineer. A small pipe leads from behind the throttle valve past it, which can be so regulated as to permit just sufficient steam to pass through it to keep the engine moving when the throttle valve is closed tightly. This saves the throttle valve and seat from being cut in the attempt to wiredraw a small quantity of steam between them, and relieves the brakesman from any care in regulating the speed when not hoisting. I think this plan more economical, and better otherwise, than letting the engines run under a governor when not hoisting, or than stopping between hoisting skips. This enabled me to get the diagrams without trouble, when the question of throttle openings and small steam pipes came up."

The diagrams in Fig. 20 are from one of the two cylinders of a coupled engine, the dimensions of cylinders being 22″x42″. They were taken at a speed of 42 revolutions per minute; boiler pressure 60 lbs. The cut-off is of the Meyer type, and at the time of taking these diagrams was adjusted to cut-off at about 12″. The steam was supplied for both cylinders through a pipe 1½″ diameter, in which was one elbow and an angle valve, the total length of the 1½″ passage being about 30″. The mean effective pressure is 14 lbs., so the engine was doing 96 horse-power of work.

Data on the diagram represent that the clearance space, up to the cut-off valve face, at the crank end was filled with 15.75 lbs. of water at a temperature of 70°, and at the head end with 16.28 lbs. The clearance spaces at the two ends being so nearly alike, in capacity, it will be sufficiently accurate to take the space represented by the mean of these two quantities, viz: 16 lbs. (neglecting the inconsequential fraction) as the clearance for each end. A cubic foot (1728 cubic inches) of water at a temperature of 70° weighs, say, 62.25 lbs., then 16 lbs will occupy a space of

$$\frac{1728\times16}{62.25}=444$$

cubic inches.

Taking the area of the piston as 380 inches, the displacement for a stroke is $380\times42=15{,}960$ cubic inches, and the per cent. of clearance is

$$\frac{444}{15960}=.028.$$

The length of the diagram is 4.3 inches, so the clearance lines are located at $4.3\times.028=.12+$inch from the beginning of each diagram.

This is near enough for all ordinary purposes. When, however, it is desirable to make more refined calculations the clearance for each end may be calculated separately, taking into account the area of piston rod, temperature of cylinder, etc. The diameter of piston rod is $2\frac{3}{4}$ inches.

The reading of barometer is given on these diagrams as 28.3 inches, and it is from this that the vacuum line should be established. One pound pressure per square inch

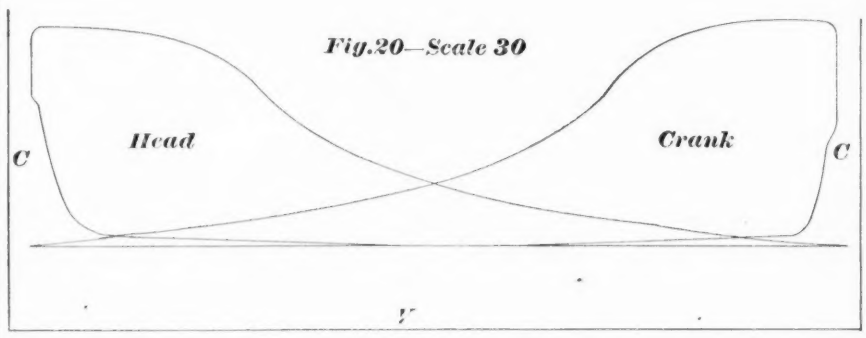


Fig. 20—Scale 30

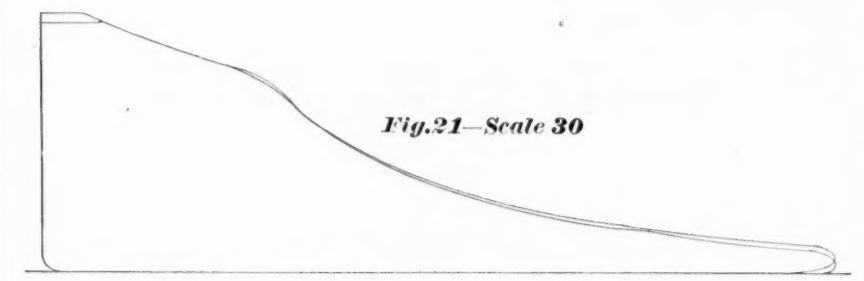


Fig. 21—Scale 30

is equal to 2.03601 inches of mercury, hence 28.3 inches of mercury is equal to

$$\frac{28.3}{2.03601}=13.8+\text{lbs.},$$

the distance the line **V** should be below the atmospheric line.

Diagram 21 is from one end of a cylinder 20″×36″; boiler pressure 62 lbs., revolutions per minute 42, steam cut-off with Meyers' cut-off at 8″. Diameter of piston rod $2\frac{3}{4}$ in.; clearance 9 per cent. The steam was supplied through a one inch pipe, in which there is an angle valve, but no elbow. The length of the pipe is four feet. The mean effective pressure of this diagram is 19 lbs., horse-power represented not quite 38.

The data are complete enough in both instances so that those interested in the subject can calculate for themselves the amount of dry steam exhausted, and it will be safe to calculate that the quantity that passed through the pipe in either instance was not less than 20 per cent. greater than that accounted for by the indicator.

Paper gas pipes are coming into use abroad. They are made by passing an endless strip of hemp paper, the width of which equals the length of the tube, through a bath of melted asphalt, and then rolling it tightly and smoothly on a core, to give the required diameter. When the number of layers thus rolled is sufficient to afford the desired thickness, the tube is tightly compressed, the outside sprinkled with fine sand, and the whole cooled in water. When cold the core is drawn out and the inside served with a waterproof composition. In addition to being perfectly tight and smooth, and much cheaper than iron, these pipes, it is said, have great strength, being tested in some instances at a pressure of fifteen atmospheres and over, which pressure they withstand without showing any signs of giving way. If buried under ground they will not be broken by settlement, nor when suddenly shaken or jarred. The material being a bad conductor of heat does not readily freeze.

Fast Train Running in the South.

It is only a few years since the lamentable condition of Southern railroad tracks was a source of endless derision for satirical newspaper writers, and the terror of travelers who had to make long journeys in the South. The great improvements that have been effected on these roads of late years are well illustrated by the speed that trains are now run between Northern & Southern cities over different systems of roads. A recent telegram from Cincinnati to a morning paper said that a special train of five cars which left that city for New Orleans over the Erlanger roads with excursionists to the Knights of Pythias Convention, made the run in 23 hours and 20 minutes. It was the most remarkable run ever made south of the Ohio. Without any allowance being made for stops the average speed was 38 miles and a fraction an hour. Subtracting the time lost by an accident near Chattanooga, and in changing engines, &c., the actual speed is shown to have been an average of a fraction over 43 miles an hour. During the Mardi Gras festival the Erlanger and the Louisville and Nashville Roads ran special trains to New Orleans which left Cincinnati the same hour and with the intention of racing the entire distance. An accident to a freight train blocked the track before the Erlanger special for several hours, and the Louisville and Nashville train won the race, making the distance in the previously unequaled time of 28 hours and 15 minutes, which gave them an average speed of 33 miles an hour, a speed that would quite likely have been equaled by that of the competing train but for the delay.

Mechanics in England.

A leading mechanical engineer of Manchester, England, who made a tour of the United States and Canada last summer, and made a pleasant call at this office, mentions in a private letter some facts that may be of interest to our readers. He says: "We are making a great fuss over education now-a-days on this side of the Atlantic, but the results, I am afraid, are not commensurate with the noise made. It appears to me the system carried out in our public schools is a very questionable one. There is too much of rewards that induce the taught to cram. * * * The result is an amount of high pressure all round, which is beginning to tell on those children from whom we should obtain the best results—I mean those of delicate constitution with active mental qualities. Among our operatives, I am informed by large employers that a great change for the better has taken place in the conduct of the employed. There is more regular attendance at work, and less drunkenness. But they say that when young men show any special aptitude as engineers, they generally find their way to your side of the Atlantic; for, of course, they have there more chance of getting on in the world. There is but small chance here for any one devoid of influence to rise, competitive examinations notwithstanding. Men are now more discontented than they were a decade ago—a sure indication of progress. Still we have a great many drawbacks to contend with. Some of the masters look upon education as being the principal cause of men taking less interest in their work and turning to politics. There are honorable exceptions, where rewards are offered for improvements in tools or methods of working. Now-a-days the work done by machines takes a great deal out of the hands of the mechanic, and consequently less ingenuity is demanded from the workmen. Take, as an example, the construction of a marine engine. I can recollect the time when the 'leading hand' had to mark out every piece and make it come in. Now the making of such an engine, so far as the fitters are concerned, is merely putting the several pieces together, which almost any one can do. It shows progress, but less manual skill is required."

Making Power Out of Nothing.

An inventor, writing to the *Railway Age*, says he has invented a locomotive which is simply old methods under new conditions, and they produce a locomotive that will easily run one hundred and twenty miles an hour; as easily as the present locomotive will run sixty miles an hour. It will move a train of from seven to ten cars one hundred miles an hour, and keep a continuous speed at that rate. He claims to have shown the drawings to several master mechanics, all of whom pronounce the engine perfectly practicable. Its weight, with tender, coal, wood, water and sand, will be about forty-five tons. We recognize this machine, which the latest inventor tries to bring into new notoriety, as an old acquaintance. He is sensible as describing it as an old method, since it is nothing more nor less than an old perpetual motion scheme repainted. To move a train over a railroad requires a certain expenditure of power, the extent of which is well known to those familiar with the mechanical principles applied in railroad operating. Increase of speed can only be obtained with a train by the expenditure of increased power, just as that result is reached in other mechanical operations. We have often thought that the parties who are always promising to revolutionize the speed of railroad trains and of steamboats by sleight-of-hand methods would gain valuable enlightenment by spending a few weeks pulling the oars of a row-boat. They might learn in a way not easily forgotten that a speed of four miles an hour can be maintained at a much smaller expense of muscular energy than that needed to increase the speed to eight miles an hour.

Inventors appear every few years who propose to obtain power to increase the speed of locomotion by mechanical manipulation alone, and, singularly enough, they receive encouragement in numerous instances for their schemes from men who ought to be beyond the deception of such fallacies. The Fontaine locomotive was a case in point, and the machine under consideration is, no doubt, of the same kidney. A locomotive, with tender and supplies complete, only weighing forty-five tons, is not likely to be capable of generating the steam needed to move a train weighing 200 tons at a speed of sixty miles an hour, and keep it up for any distance.

To keep a train whose total weight is 200 tons running on a perfectly level track free from curves at a speed of sixty miles an hour, requires a tractive force expenditure of about 1,275 horse-power. A large boiler is needed to supply the steam for this great power. No manipulation of leverage will dispense with the steam represented by a single stroke of the piston.

Men who talk about maintaining a speed of

one hundred miles an hour are generally so ignorant of the subject of train resistances that their views are unworthy of discussion.

Constructing Gear Patterns.

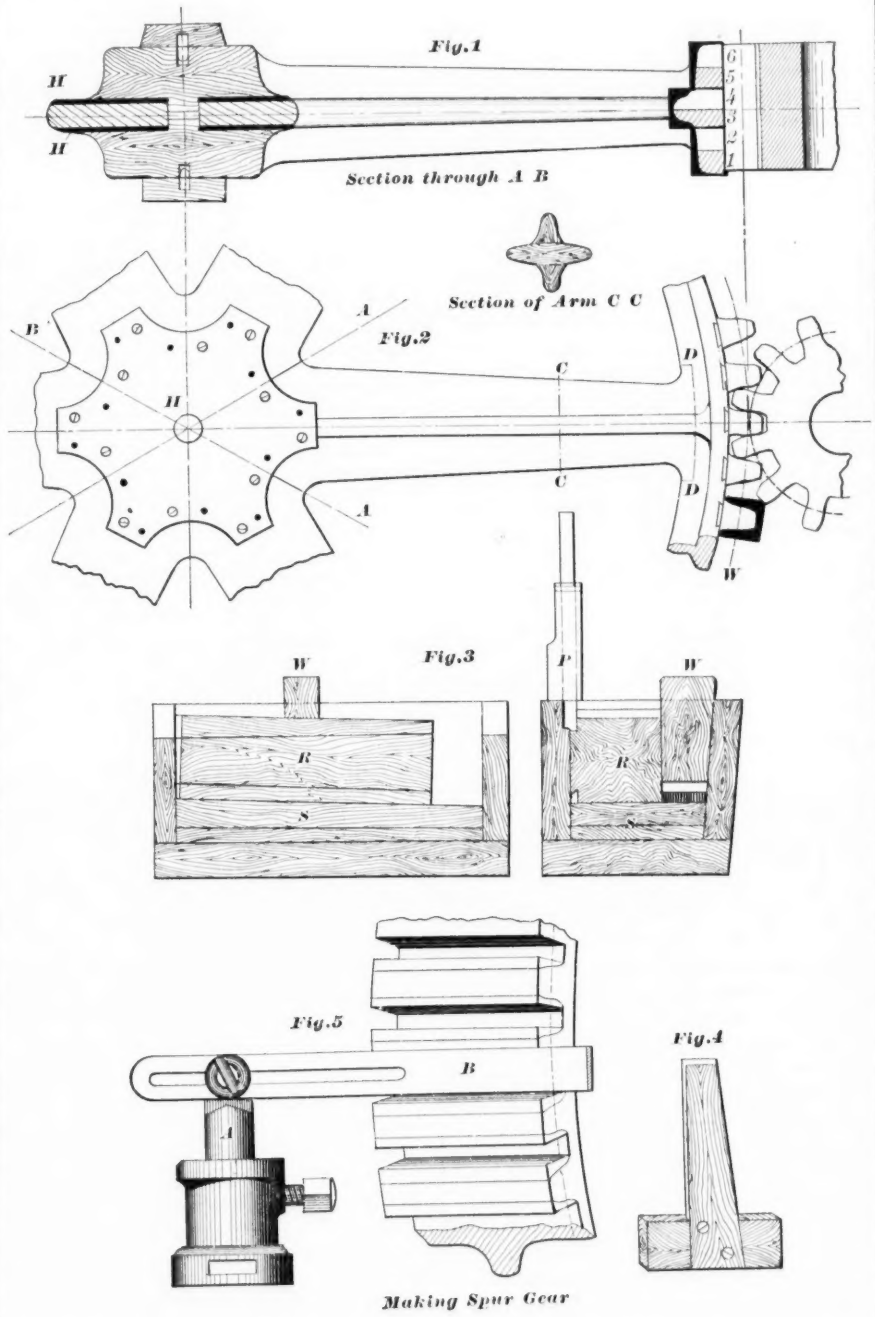
BY ISAAC WHITEHEAD.

In this paper I will confine myself to the construction of gear patterns from drawings furnished. There are two kinds of gear wheels in common use, spur and bevel. The first transmits motion when the shafts are parallel, and the latter when they are inclined to each other. The smaller of two gears working together is called the pinion, which name is often applied to small gears generally. In Figs. 1 and 2 is represented a spur gear and pinion, the construction of which may be applied to all spur gears. For a small pinion under 6″ or 8″ diameter a solid block of pine or poplar is generally used. It must be dry, and straight-grained, the teeth being formed lengthways of the grain. For gears of fine pitch, and with arms, mahogany or cherry is generally used, but sometimes for the teeth only, the rest being of pine. For large gears pine is used—sometimes substituting poplar for teeth.

To make a pinion from a solid block, it is first screwed on a face plate which is smaller than the diameter at the bottom of the spaces, so that when the block is turned to the size of the outside of the teeth, allowing about $\frac{1}{16}$″ taper per foot for draft, circular lines can be traced on both ends indicating the pitch line, the line for the roots of the teeth, and also circular lines for the centers used in forming the flanks of the teeth. Some pattern makers think to strike perfection by giving no taper to the teeth, but when we consider that if we do not help the moulder he will help himself to strip by extra rapping, I think it is safer to do it ourselves; besides the lower part of the mould will always run larger or fuller than the upper, and this will largely make up for the slight strip that is needed. When there is not a face-plate small enough to clear the teeth, then bore a hole in the block and turn it upon an arbor formed of hard wood.

For solid pinions larger than 6″ or 8″ diameter the body should be built up in segments, as shown in my paper on "Construction of Circular Patterns," Fig. 2, and the teeth planted on separately with dovetails. In all larger gears where arms or a plate are used it is generally best to construct and turn the rim separate from the arms or plate, both in respect to cheapness, accuracy and strength. In the case of a plate wheel, to build the plate with the segments glued upon one or both sides, then the shrinkage strains would tend to contract or expand the rim across its grain; therefore it is better to build the rim separate with the hollow and a portion of the plate formed on the inside in which a separate piece for plate will be fitted with a ledge, and glued, so forming the center. To build the arm up into the rim, where the rim is so light as in the case of gears, tends to weaken the rim at these points, and it is more difficult to finish the rib or bead which generally runs on the inside of the rim.

Having built up the rim, while it is setting and hardening, get out the arms. Arms are generally made by getting out pieces of wood twice the length from the center to *D*, Fig. 2, the width of the joint *A*, *A*, and the thickness of the arm at the center. If six arms, then three lengths are required. They are let one into the other at their centers as they cross each other, forming six equal angles, by dividing the thickness into three equal parts. Another and a stronger one for large centers is to get out the wood in six pieces half the length of the former, and make a joint from the center to *A*, butting them together with glue. When dry take the two cast plates *H*, with holes drilled in the center of each, suitable for hub pins, set the hole in the center of the joints, and let it into the arm level on each side. The screw heads, as shown on one side of the plate, Fig. 2, would, when reversed to the other side, take hold of the wood in the points shown by the dots. Set a hard wood plug in the center, and with the radius at *D*, strike off the length of each arm. On this radial line space off a center for the arms, equally. Lay down the center line of the arms, from which produce the outline, which is next cut out. See that one face of the arms is true and straight, one arm with another, then from this gauge the necessary taper of the arms on the end and plane down to it, and dress the edges of the arms to the shape required. Now, turn up the inside of the rim to a template, giving ample strip so that the sand will easily lift up with the cope. About $\frac{3}{8}$″ or $\frac{1}{2}$″ to the foot taper is sufficient. Now let in the arms carefully in the center, glue, and screw from the outside. Turn off



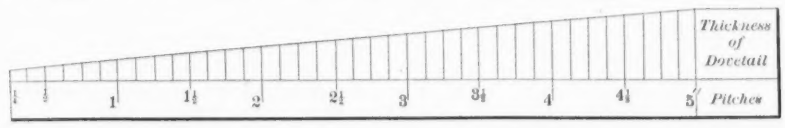
Making Spur Gear

the outside of the rim, allowing a slight draft of about $\frac{1}{16}$″ to the foot upon its face, and mark upon it a fine line upon which to space off the face for the teeth, and also one line on each edge showing the depth of dovetails. In spacing off, when the number of spaces required is divisible without remainder, it is better to lay off the larger divisions first. For instance, for 60 teeth divide the circumference into 6 parts, then subdivide each by 2, then by 5; or by 10, instead of 2 and 5. If 59 teeth, lay off the radius chord, and space $9\frac{5}{6}$ parts; or if 61 teeth, into $10\frac{1}{6}$, and so on, the fraction being the guide as to how you will come out on the whole circle. This will save spacing the whole wheel round for each trial, and be more perfect, because of the fewer points made in spacing. Be careful to have the compass points fine and sharp and the legs firm.

To lay out the dovetail on the face, make a T template, the blade being the taper required, as shown in Fig. 4, and by setting one edge of blade to each spacing, and scribing both edges, we obtain the whole outline of dovetail. The accompanying scale gives a good proportion for depth, as they should not be cut so deep, or the dovetails driven so hard, as to strain the rim out of round. Saw to the lines at an angle of about 45°, by the eye, and pare out the groove with a chisel having bevel edges on the back, so that it will cut clean under the bevel

For the teeth saw out strips $\frac{1}{8}$″ larger than finished size, as shown at *R*, Figs. 2 and 3. Face one side and saw into lengths $\frac{3}{4}$″ longer than the finished length.

A good device to work the dovetail on the teeth is shown in Fig. 3, with the front of each view taken away to show the inside. *R* is the tooth block; *S* is a false bottom, the bevel or taper of the dovetail, which can be raised or lowered by packing underneath. *W* is a wedge to keep the block against the face of the box, while the plane *P*, working against the side, planes down the thickness of dovetail. The false bottom is turned end for end to plane the other side of the dovetail. By this means the dovetails are made all alike at one operation, and so are easily fitted to their places. After driving each one home with equal force, mark the projection of the ends, drive each one out separately, and saw off the ends square, allowing $\frac{1}{32}$″ for turning. Number the teeth and spaces, and drive the teeth home. The teeth can then be turned down to the size, and the pitch line and lines for centers turned upon the ends. Great care is necessary in turning the ends. First, go over them very lightly with a diamond point, then finish with a chisel, held firmly, but cutting lightly. Space off the pitch centers of the teeth, the thickness, and the flanks, of one side of the wheel only.



A good device to transfer the points from one side to the other is shown in Fig. 5. The pin *A*, is of hard wood, and is made to fit the socket of the lathe-rest, while the blade *B*, is best of sheet iron or steel, as the lines marked from it require to be very fine. Set this in the place of the rest and adjust the blade to the strip required on the thickness of the tooth, and with it transfer the intersection of the flank with the point of the tooth, across the face of the wheel for one side of the tooth; then change the strip to mark off the other side. From these points squared across with the radius for flanks, lay out the teeth on the other side of the wheel. This is quicker and more reliable than spacing off both ends of the teeth, which is commonly done, as one spacing answers, and it also insures a perfect draw on the teeth.

Having laid off the teeth they are taken off and pared down to the line at each end, then planed with a round and a finger or rabbet plane. To hold the tooth block firm and handy put a piece of board in the vise and notch it out on the edge a little longer than the tooth, so that you can set a wood wedge in the end while you plane it. When finished the teeth are set in with glue or varnish, sometimes leaving 2 or 3 loose ones, in case the moulder should need them to mend up some time.

The hubs are next turned with a pin in the center to fit the plate, as shown, with prints separate. The bottom print has but slight taper, because in using a standard core box and cutting the core to the length one end will be straight, while the other may be beveled. If the arms are required to be ribbed, as shown in Figs. 1 and 2, the top ribs are left loose with two dowel pins each. In this style the lifting and rapping plates should be let into the rim and well secured at equal distances apart, the number depending on the size of the pattern, etc.

Other ways of putting on the teeth, such as shaping them out in a die-block, and nailing them on; or getting out the dovetails separate and gluing and nailing them to the tooth block, I have tried, and consider them inferior in every way to this, even in cost. If a shop is properly fitted up to do the work according to the system shown, it can be done very quickly in comparison, and it insures a more correct pattern, which is the chief essential of *cheap* gears. A fine camel hair brush should be used in varnishing teeth, and the varnish should be rather thin.

A very curious accident happened on an English railway some time ago, which led to an expensive lawsuit that has attracted much attention. Locomotive builders in Europe counterbalance the weight of the link motion by means of a heavy block of iron fastened to a lever, which is connected with the tumbling shaft. While two trains were passing each other on the road, this balance weight slipped away from its position on one of the locomotives, and dashed up through the floor of a carriage belonging to the passing train, seriously injuring two gentlemen who were passengers. On a suit being brought against the company for damages, the defence was raised that the accident was unavoidable, could not have been foreseen, and that therefore the company was not responsible. The jury concluded otherwise, however, and gave a verdict for $20,000. An argument used by the defence was that such balance weights were an absolute necessity for the operating of locomotives. Had the other side understood American practice in this respect, they could have answered that here a spring was used instead of a weight, and that the purpose was thus served equally well.

In last week's issue we published a communication on foundry matters from an English correspondent which, we think, goes to show that they melt iron in England with less fuel than is used for the same purpose in this country. We have before seen in English papers accounts of melting as high as fourteen lbs. of iron to one lb. of coke.

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NEW YORK, MAY 24, 1884.

CONTENTS.

	PAGE
The Hewes & Phillips Corliss Engine	1
Universal and Combination Lathe Chucks. By Fred. J. Miller	1
The Result of Imperfect Setting of Horizontal Tubular Boilers By George Marshall	2
New Profiling Machine	3
Porter's Adjustable Pipe Wrench	3
Greely Relief Steamer Alert	3
Elements and Manufacture of Foundry Facings. By Thomas D. West	4
Closing Up of Tube Holes	4
Work on the Panama Canal	4
Letters from Practical Men—The Throw of Eccentrics—A Complaint About Lubricating Oil—Steam Pipe and Throttle Valve	4, 5
Laying Out Link Motion By J. G. A. Meyer	5
An English Locomotive Improvement Scheme	6
The Indicator Diagram. By F. F. Hemenway	6
Fast Train Running in the South	6
Mechanics in England	6
Making Power Out of Nothing	6
Construction of Gear Patterns. By Isaac Whitehead	7
Exclusiveness in Machine Shops	8
Importation of Textile Machinery	8
What is "Horse-Power?"	8
Literary Notes	9
Questions and Answers	9
Manufactures	9

Exclusiveness in Machine Shops.

A few years ago it was a very difficult matter for a stranger to get permission to visit machine shops or any leading industrial establishment in Europe. The proprietor of nearly every machine shop imagined that he had some special method of doing work that was unknown to the rest of the world, and he supposed that his interests would suffer were strangers permitted to witness his operations. This bred a spirit of exclusiveness that was antagonistic to progress, and the most antiquated tools and methods were cherished under the delusion that they had not yet become moribund. For some time this spirit of supposed secrecy has been dying out in England, although in many continental establishments the practice of excluding strangers is still rigorously enforced. A curious feature about the custom is that the places most prone to be surrounded with impenetrable mystery are generally one-horse concerns, whose tools or methods none but lunatics would copy (although there are occasional exceptions). This spirit is at rare intervals met with in America, and the shops that cannot be seen are generally antiquated concerns, that are moving towards bankruptcy by the owners failing to avail themselves of the improvements adopted by their neighbors.

An indication that this spirit of exclusiveness still lingers in some English works has been brought out rather prominently recently. A custom has grown up in connection with the Institution of Mechanical Engineers, the Iron and Steel Institute, and other British technical societies, of holding their meetings in some city where manufacturing establishments could be visited. Following this custom, the Iron and Steel Institute intended holding their next meeting at Sheffield, but the leading iron masters of that city gave notice that they would not admit the members of the society to visit their works. They were afraid that Americans and Germans would slip into their works, under the protecting mantle of the Iron and Steel Institute, and carry away important trade secrets that would be used to the injury of Sheffield manufacturers. We think the fears of the Sheffield iron masters are entirely groundless so far as they relate to Americans. If they have any trade methods that are worth imitating by American metallurgists, we feel assured that our people would be enterprising enough to discover the necessary particulars without waiting for permission to walk through the works.

Importation of Textile Machinery.

Consul Shaw, at Manchester, England, reports that for the year ending Sept. 30, 1883, the value of machinery exported from his district to the United States was $1,365,702.39. For the quarter ending Dec. 31, 1883, the value was $233,118.93. Since the new tariff went into force July 1, 1883, and the duty on machinery became 45 per cent. in place of 40 per cent., the old rate, importations of machinery have declined 30 to 50 per cent. Unpleasant as this may be to free traders, it is gratifying to American machinery manufacturers and all friends of home productive industries. There has been a large demand for textile machinery in this country since the tariff was advanced, by reason of the erection of new mills; but the demand has been promptly and satisfactorily supplied, without depending so much upon Manchester as heretofore. Furthermore, the price of textile machinery has not been advanced since the tariff was raised. On the contrary, a cotton or woolen mill can now be equipped with the best machinery, all of American make, at a lower price than it could have been obtained under the old tariff, which was 5 per cent. lower.

A correspondent asks us to state what great feature or principle Mr. Keely claims for his motor. We give it up. We always did give it up. What Mr. Keely claims has been, is now, and apparently always will be, past finding out. A number of (pecuniarily) interested parties have exercised themselves during the past five years in trying to find an answer to this question, but we think they have lost their interest in the matter.

What is "Horse Power?"

We receive a number of inquiries, says the AMERICAN MACHINIST, every week asking the horse-power of boilers and engines. The horse-power of a boiler is a meaningless expression, because there is no agreement as to what evaporation of water shall be considered a horse-power, and hence no standard in law or practice. The expression is properly enough used by boiler makers as expressing the relative capacity of different boilers, as it is a matter of necessity for them to use some form of expression, and in the absence of something definite, this is perhaps as good as any. The horse-power of an engine can only be determined by actual trial but if the dimensions of cylinder, valves, and ports, together with the character of valve motion, the speed at which the engine is to run, the boiler pressure, length and diameter of steam and exhaust pipes, and the use to which the engine is to be put are known, the horse-power that it will satisfactorily develop can be reasonably approximated. These data seldom accompany the queries, and hence they are useless for the purpose for which they are intended.

"We think our able and always-looked-for contemporary is somewhat 'off color' in the above broad and assertive remarks. They are calculated to make the impression that both the contracting for and the making of steam engines and boilers have been on a phantomical basis, little better than sheer guess work, and that the frequent inadequacy of either or both and the explosions of the latter we almost daily hear are due to a 'rule of thumb' method of contracting and constructing.

"The following figures in regard to boilers are taken from W. G. Hamilton's book, Useful Information for Railway Men, compiled for the Ramapo Wheel and Foundry Company and relate to an ordinary horizontal flue boiler:

One actual horse power equals 33,000 pounds raised one foot in one minute. Applied to steam engines it is the mean steam pressure on the piston, in pounds, multiplied by the velocity of the piston in feet per minute divided by 33,000. From this deduct 25 per cent in condensing engines and 13.1 per cent. in high pressure for working friction and pumps, and the balance will be the actual horse-power.

"One horse-power in a *boiler* is its capacity to generate enough steam in one minute to raise 33,000 pounds one foot. The capacity of a boiler to generate steam is, of course, governed by the form of the boiler, whether tubular or not, and whether the boiler and its flues or tubes are horizontal or vertical.

In boilers, for each horse-power there is required
1 cubic foot of water per hour.
1 square yard of heating surface.
1 square foot of fire-grate surface.
1 cubic yard of capacity.
28 square inches of flue area.
18 square inches of area over bridge wall."

—*Industrial News.*

We are obliged to our polite and valued contemporary for calling attention to what it believes to be an error on our part. At the same time we fail to see the error, and have given room to its remarks because we think an error of its own should be corrected. How it gets the impression that our remarks, which were in the nature of a hint to those who ask us questions about the horse-power of engines and boilers to give full particulars, were in any way an insinuation against the methods of builders of engines and boilers, will, we think, be as much of a puzzle to its readers as it is to us.

We do not suppose a single reader of either the *Industrial News* or the AMERICAN MACHINIST needs being told that an "actual horse-power equals 33,000 pounds raised one foot in one minute," but since the friction in one engine may be, and often is, twice that in another—since it varies with the size of the engine, and since in the same engine the friction will be different under different conditions of working—we fail to understand of what use the percentages of friction quoted will be to the readers of either.

The dimensions of a cylinder (diameter and stroke) no more furnish all the data necessary to determine the horse-power of an engine than the weight of a horse indicates how much work he can do. For instance, we have before us the catalogues of two prominent steam engine builders, in one of which an engine with cylinder 16″x38″ is rated at 75-horse power, while in the other a cylinder 12″x18″ is rated at 80-horse power. Both these builders are probably right in their ratings.

Our contemporary says: "One-horse power in a *boiler* is its capacity to generate enough steam in one minute to raise 33,000 pounds one foot." One engine requires 50 lbs. of steam per horse-power per hour, and another 20 lbs. By which engine shall the capacity of the boiler be measured? To settle this, it quotes from a work on the subject: "In boilers, for each horse-power there is required 1 cubic foot of water per hour." At the tests of boilers at the Centennial Exhibition, the horse-power was gauged by the number of times 30 lbs. (less than one-half cubic foot) of water evaporated per hour, and that rating is the one most generally employed at the present day, with a fair prospect of its becoming a standard. A steam engine manufacturer who proposes to sell engines on the basis of requiring one cubic foot of water per horse-power per hour will be likely to do a very limited amount of business, and as a matter of fact, we do not know of any extensive manufacturer of boilers who sells by the horse-power and guarantees the evaporation of that quantity of water.

Our attention has been drawn by a correspondent to an apparent contradiction in the articles on "Laying Out Link Motion," by Mr. J. G. A. Meyer, where he defines the eccentric throw as the distance between center of axle and center of eccentric wheel; then, in the subsequent description, uses the whole linear movement of the eccentric as its throw. The mistake originated in a typographical error.

Certain German merchants have been inspired with the belief that their nation has an industrial missionary work to perform in supplying Mexico with the appliances needed to develop the natural resources of that country. The opening exhibition of Mexican products in Berlin has been lately used as the occasion for stirring up Germany to the growing importance of Mexico as a market for machinery, toys, and other articles that Germany wishes to sell. The most harassing problem considered was how to get ahead of American manufacturers, who hold a coigne of vantage through the close railroad connection and the reciprocity treaty. Since, thanks to their extremely cheap labor, German manufacturers are in many instances able to sell goods in the United States in spite of the heavy tariff, they concluded that there would be no difficulty in vanquishing this country in the Mexican market. The first installment of their industrial mission is to rush agricultural and mining machinery into Mexico. We believe that American methods of making this kind of machinery, where special tools are employed to produce parts quickly, will to some extent neutralize the advantage of cheap labor enjoyed by our German rivals, and that they are not going to walk away with the Mexican trade so easily as our Teuton friends expect. Their admirable methods of production enable our makers of clocks and sewing machines to compete successfully with German cheap labor in the open market, and every move that our general machine makers take in the direction of similar means of doing work helps to secure their independence in general competition.

Building is reported to be very active in Chicago and St. Louis, but dull in Cincinnati.

In a recent issue we published a letter from Chas. S. Beach, in which he observed that no inspector's license is required to run a steamboat on inland lakes, and suggested that the United States laws ought to apply to such steamboats, as well as to those on the principal navigable waters. We appended a note saying we thought Mr. Beach wrong in regard to exemption from license. Since then we have learned that he is right, both as to the fact and the suggestion. No license is required for steamboats plying on waters that have no navigable connection either with the ocean or with another State or foreign country. This law ought to be changed so as to embrace such waters as Lake George, Oneida, Cayuga and Seneca Lakes, upon which steamers of considerable size are run.

Literary Notes.

Berly's Universal Electrical Directory is a new publication issued by Cumming & Brinkerhoff, 219 East Eighteenth Street, New York. It gives a list of engineers and manufacturers interested in electrical matters. Price $3.

The Eccentric is a very tastefully gotten-up magazine, published by the students of Stevens' Institute, Hoboken, N. J. It makes "one revolution per annum." The illustrations are humorous and well chosen.

The Southern Lumberman, of Nashville, Tenn., is a well-edited industrial newspaper. Published twice a month at $2 per annum.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(213) **J. W. H., Boston, Mass., writes:** There are, I understand, vessels being propelled by jets of water. Will you tell me the names of parties using such means of propulsion? *A.*—There have at various times, during the past twenty years, been small vessels built and propelled in this way, but we have never learned that the means has proved in any reasonable degree a success, and do not at present know of a vessel so propelled.

(214) **A. S. M., Hudson, Mass., writes:** I am firing a pair of four-foot boilers, one each alternate week, and they do not steam free. I know that the boilers ought not to require forcing, as I have done more work with smaller boilers. I claim the fault is in the setting. There is nearly four feet of space under the shell back of bridge wall. If this space is partially filled up will I not get better results? *A.*—By filling up three-quarters of this space you will probably save fuel.

(215) **J. M., Perth, Ont., asks:** 1. Of what material is the shell or tank of the Babcock fire extinguisher made, and would it answer for a small boiler? *A.*—We believe the shell is always made of copper. We do not think it would be of much use as a boiler. 2. What distance will the largest cannon in the world project a ball? *A.*—We do not know. 3. What power is an engine 2″x3″ at 300 revolutions per minute, boiler pressure 60 lbs? *A.*—About ⅛-horse power.

(216) **F. S., Los Angeles, Cal., asks:** Do you consider it right to run an engine when it is out of line? *A.*—The proper thing to do when an engine gets out of line is, to put it in line without delay, thus avoiding injury that may not be readily repaired. There are instances when an engine cannot be stopped for lining up without involving greater loss than that of destroying some of the parts; then the only thing to do is to keep running, somehow.

(217) **D. L. M., Moline, Ill., asks:** 1. Can you give me a rule for determining the centrifugal force of a revolving wheel? *A.*—See article on this subject, by Charles T. Porter, in the AMERICAN MACHINIST of February 16 and 23, 1884; also a communication on the subject from Mathias Beck, in the issue of April 19. 2. Can you give me a short rule to figure the speed of machinery? *A.*—Your question is not definite enough. We do not quite understand what you mean.

(218) **Machinist, Pulaski, N. Y., writes:** I am in need of a cement for joining leather to iron and steel. Can you give me a recipe? *A.*—The following, on the authority of Dr. Heinischen, of Dresden, it is said, will fasten leather to iron or steel so firmly that they cannot be separated: Soak the leather with a warm solution of gall-nuts, spread thinly over the metal a solution of the best glue, hot, place the two together with a pressure on them, and leave to dry.

(219) **F. J. E., Goshen, N. Y., writes:** On a recent visit to New York, I noticed that nearly all the machinery in the different stores was painted a bluish gray color, and the castings looked and felt very smooth. Upon scraping off the paint, I found the sand underneath, so it was evident to me that the composition was some kind of filling. Can you tell me what it is made of? *A.*—It is not the custom to paint over the sand on castings. To get a smooth body, a filling is used that can be bought of dealers in painters' material. We do not know exactly of what it is made. It comes nearly as thick as putty, and the process is first to fill the holes with this, rubbing down smooth, then thining it and giving the casting a coat, rubbing down with pumice-stone, giving two or more coats, as required. Upon the smooth surface thus obtained paint of any desired color can be used.

Business Specials

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Metal & Wood Patterns—G. D. Lambert, N. Haven, Ct.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Interchangeable work a specialty. Send stamp for new Lathe Catalogue. E. O. Chase, Newark, N. J.

For first-class machine patterns and estimates, address John Valentine, 15 Alling st., Newark, N. J.

INVENTIONS perfected, designed, or patented. E. P. Robbins, M. E., Cincinnati, O.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Fine tools and special machinery. Horace Thurston, 84 Clifford street, Providence, R. I.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Consulting Engineer and Mechanical expert, C. C. Hill, 84 Market street, Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 626 E st., Washington, D. C.

National and box chucks, foot and power lathes, and slide rests. Lodge, Barker & Co., Cincinnati, O.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Coarse or difficult screws, worms, cutters, taps rotary files to order. Machinery invented, made. Tower Machine Works, E. Brookfield, Mass.

New Books, relating to steam, the steam engine, mechanics, machinery, and engineering. Send for catalogue. Fred. Keppy, publisher, Bridgeport, Conn.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

"Catechism of the Locomotive."

The most complete and easily understood treatise on the locomotive; 625 pages, 250 illustrations. $2.50. For sale by "The Railroad Gazette," 73 Broadway, New York.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

Useful Information for Steam Users—A 100-page pamphlet, compiled from the best authorities, on the care and management of the steam engine and boiler, with hints and rules for engineers and firemen. Engineers everywhere should have this work. Send 25 cents in P. O. stamps for a copy. The J. N. Mills Publishing Co., 145 Broadway, N. Y.

Manufactures.

Boyle's machine shop, Peabody, Mass., is to have an addition, 24x20 feet.

John R. Ely, Bay Side, N. Y., will erect a factory, 100x40 feet, in Brooklyn.

William Henry is erecting a small machine shop on Moore street, St. Louis.

J. H. Smith & Son, Athens, Tenn., will build an extension to their foundry.

N. S. Sherman & Co. will start a foundry and machine shop at Jackson, Tenn.

An effort is being made to organize another cotton factory company in Rome, Ga.

Twenty thousand dollars has been subscribed towards a cotton factory in Troy, Ala.

M. M. McCuen, of Philadelphia, will erect a new factory on Long Lane, near Reed street.

S. Brownell, Ironton, Wis., proposes to erect a 100-ton iron furnace somewhere in Alabama.

Staats & Dillmier, First and South Seventh streets, Brooklyn, N. Y., will erect a foundry 20x40 feet.

Madison, Ind., is to have a $100,000 foundry, a joint stock company having been organized for that purpose.

The United States Electric Light Company, of New York, propose to establish branch works in New Orleans.

The Industrial Machine Works has been incorporated at Jacksonville, Fla., by George F. Drew and others. Capital $50,000.

The Seth Thomas Clock Company, Thomaston, Conn., have built an addition, and are going into the manufacture of watches.

The Penitentiary Board, Austin, Tex., will build a foundry and also establish water works, to cost about $7,000, at the penitentiary.

The Dearborn Foundry Company, Chicago, are to erect a new three-story foundry building to cost $5,200.

William Booth, Evergreen avenue and Woodbine street, Brooklyn, N. Y., will erect a small foundry in that city.

A number of Pittsburgh and Sandusky, O., capitalists are negotiating for the purchase of the Nes Silicon Steel Works, at the latter place.

Among the towns in Texas about to have new water works are: Sweetwater, Albany, Waco, Victoria, Corsicana, Belton, Cleburne, and Terrell.

H. W. Harris, 313 Walnut street, Philadelphia, has introduced Frick's Connellsville coke into about sixty foundries since his office was opened, Jan. 1st last.

Jallings & Manning is the title of a new firm established at 80 Market street, Chicago. They will do a general business as machinists, millwrights, elevator-builders, and repairers.

The Crosby Steam Gage and Valve Company, of Boston, has just executed an order from Dubs & Co., the locomotive builders of Glasgow, for fifty of their 5″ Crosby Pop Safety Valves.

Besides a large amount of other work, the Southwark Foundry and Machine Company, of Philadelphia, have now in process of construction eight Porter-Allen high-speed engines, all sold.

A. Edw. Barthel, 111 Liberty street, New York, has got out a new catalogue of his lubricators and solidified oil. The catalogue is both illustrated and illuminated with bright colors and gilt.

In our description of the Dancel vertical milling machine last week, we should have said that it was especially designed for milling dies. The builder is C. Dancel, 239 Center street, New York.

Hetherington & Berner, Indianapolis, Ind., recently made a boiler said to be the largest ever built in that city. It is 6 feet diameter, 18 feet long, and weighs 10 tons. It was made for a farm in the vicinity.

Smith & Haldeman, Toledo, O., will, within the next few weeks, erect a three-story building of 80x120 feet dimensions. The first floor will be devoted to a machine shop, in which they will manufacture their elevators.

Connor & Yairns, Rusk, Tex., will build and operate another blast furnace for the State, also make some changes in the present furnace. The manufacture of car wheels from the iron now being made is to be begun immediately.

The Putnam (Conn.) Foundry and Machine Company will erect a foundry 50x100 feet, and a machine shop 30x100 feet. Orrin Morse is president, D. H. Billings vice-president and general manager, and W. R. Barber secretary and treasurer.

William B. Bement & Son, Philadelphia, inform us that, while they have not orders ahead on their books to the extent they had this time last year, their sales of machine tools so far, this year, exceed in amount the corresponding date last year.

The Norwalk Iron Works Company, of South Norwalk, Conn., recently built an air compressor to operate the dynamite gun. It was intended for only 350 lbs. pressure per square inch, but has been successfully worked up to 500 lbs. pressure.

W. R. Woodward, of St. Louis, receiver of the Texas and St. Louis Railroad Company, says the machine and car shops of his road to be built at Pine Bluffs, Ark., as previously mentioned, will be put up at once. Expect to employ several hundred hands.—*Baltimore Manufacturers' Record.*

Lewis Miller, of Akron, O., has just been elected president of the American Locomotive Headlight Company, with $6,000,000 capital, incorporated in Indianapolis. The directors are Akron, Dayton, and Indianapolis men. Dayton or Akron will get the shops, with chances in favor of Akron.

The Norwalk Iron Works Company have built a second air compressor for the dynamite gun, which is calculated to compress air up to 2,000 lbs. per square inch. The steam cylinder is 14″ diameter, air cylinder 9½″, and compressing cylinder 2 1-16″. It has just been shipped to Fort Hamilton.

The Stiles & Parker Press Company, Middletown, Conn., have leased the whole building at 59 Duane, corner of Elm street, New York, and are now equipping it with machinists' tools. This shop will be a branch manufactory of presses, dies, and special machinery, to accommodate their local trade in New York.

The machinery firm of S. C. Forsaith & Co., Manchester, N. H., which dates from 1860, has been merged into a stock company, The S. C. Forsaith Machine Company, with $275,000 paid up capital. D. B. Varney is president, S. C. Forsaith treasurer, and W. E. Drew agent; the management remaining the same as before.

We have received a photograph from the Cordesman & Egan Company, of Cincinnati, giving a view of their wood-working machinery shops, with thirteen feet of water on the street. The photograph was taken in the diluvian era of last February. We have had it framed and hung upon the wall of our office. It only lacks a few gondolas in the foreground, being paddled by Italian bandits, to be mistaken for a scene in Venice. The company write us: "Bad as things look, we were straightened out within a week after the subsiding of the water."

For the manufacture of Crane's patent automatic lock, a company has just been incorporated, with a capital of $10,000, to be known as the Chicago Automatic Lock and Brass Manufacturing Company. In addition to their new lock, the company will manufacture other hardware specialties.—*Western Manufacturer.*

The *Industrial World* is responsible for this item: The following letter, which speaks for itself, was recently received by one of our prominent dealers in emery wheels: *Dear Sir*—The last emery wheel bought of you burst, seriously injuring my brother. My mother-in-law has gone into business with me. Send me a dozen wheels like the last. Yours, etc., B

The Kensington Engine Works, Vienna and Beach streets, Philadelphia, have purchased a plot of ground alongside their works, and intend to erect an addition as soon as the city locates the extension of Vienna street. They report orders fair for steam engines, pumping engines, and marine work, but say prices are low. In all departments, about one hundred men are employed.

The Innes Manufacturing Company, Oil City, Pa., write us: We just finished our 125th engine, all 9x12, for the month of April, which closes our month's work quite satisfactorily to us. We have just finished an addition to our foundry, and two to our machine shop, and, with the new tools we are putting in, will be able to turn out one hundred and fifty per month when the trade demands them.

The Wicaco Screw and Machine Company, of Philadelphia, have built for H. Troemner, 710 Market street, Philadelphia, a Parham turret machine, to carry brass rod 1⅝ inch diameter, for the purpose of milling their brass scale weights complete from the rod, instead of turning up castings as is usually done. The machine has been in successful use for this purpose for the past five months.

The Worcester, Mass., *Spy* says: The Worcester Malleable Iron Company—Mason, Bowker & Lumberg—who started to do business about a year ago, are adding two new annealing furnaces to their works, each one to contain five tons of iron. They also have under consideration the putting up of a furnace for making ferromanganese steel, and hope to make another addition to their buildings within a short time.

E. P. Bullard, 14 Dey street, New York, has recently redesigned his 21-inch lathe, and introduced several important improvements. His old-style lathe, of this size, was illustrated in the AMERICAN MACHINIST, September 8, 1883, and attracted considerable attention. The new design possesses all the best features of the old lathe. A convenient improvement is in the method of throwing the screw-cutting gear into action, an eccentric shaft moving the gear into place by a single action. The gears are held on by a slotted washer, which can be slipped out when the nut is slacked, then the gear can be moved off without removing the nut. This is found to greatly facilitate the work where many changes of screw cutting have to be made. The new lathe has a box-leg, which makes quite a change in its appearance.

Manning, Maxwell & Moore, 111 Liberty street New York, write us: "We have just been awarded the whole order for machine tools, including heavy planers, lathes, shapers, drills, and small tools; also, shafting hangers, pulleys, etc., for the Clark & Granger Manufacturing Company, Detroit, Mich. The company have organized for the purpose of building compound marine engines for the lake service. The company is composed of large steamship owners and capitalists of Detroit. The mechanical superintendent will be Mr. Harry Granger, who is well and favorably known as a very able mechanic. He has designed and superintended the construction of a large number of the best compound engines on the lakes. We also understand Mr. Frank Kirby is connected with this company. The award of contract to us is very flattering, in view of the fact that we secured the order against active competition from several of the largest machine-tool concerns in the country."

The Philadelphia Machinery Company have sent the following circular to the members of the United States Senate and House of Representatives: "We wish, most respectfully, to protest against the House bill No. 3617, in regard to reducing the life of a patent from seventeen years to five years. We are about to inaugurate business under patents issued to our Mr. Daniel Mills during the last four (4) years, all of which time we have spent in experimenting and perfecting the specialties we propose to commence the manufacture of, this year. Our experiments and special tools have cost us over $40,000, and a like amount will be required for the plant to produce but two of our new perfected machines, viz.: a leather stitcher, for sewing three hundred stitches per minute with a waxed thread through an inch thick. And a button-hole attachment for any family sewing machine to make five holes per minute; sample inclosed. The perfection of such things is rarely accomplished except by sinking large amounts of money and doing the hardest kind of work. We wish also to protest against Senate bill No. 1588, as we feel that, if it passes, inventors and owners of patents will have no protection. We are now negotiating for the introduction into the United States of a foreign invention that will cost at least $20,000, but under any such law as the above bill contemplates we had better stop short, and would have to look to Europe for profits on what we have already done; and in the future, let all new things severely alone, because the development and perfection of new things would be throwing time, labor, and expense away."

Machinists' Supplies and Iron.

NEW YORK, May 8, 1884.

The supply business looks slightly better than it was a week ago, but prices continue depressed.

Boiler-makers' supplies are unchanged. The demand for boiler plate is quiet.

Iron, pig, American—The market remains outwardly unchanged. Standard brands are scarce in consequence of light production, but prices are unaffected. We quote No. 1 X Foundry, $20 to $20.50; No. 2 X $18.50 to $19; Grey Forge, $16.50 to $17.

Scotch pig—The market has ruled dull and unsteady, with the tendency of prices still downward. Coltness $21.50 to arrive, $22 from yard; Glengarnock, $21 to arrive; Gartsherrie, $21.50 to $22; Summerlee, $20.50; Carnbro, $19.50; Eglinton, $19.50.

✲WANTED✲

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Experienced draughtsman wants temporary work. Address "Good Machinist," AM. MACHINIST.

Foreman boiler maker, thoroughly posted, wants position. Satisfactory references. Address Box 8, AM. MACHINIST.

Wanted—Situation by first-class pattern maker, who has had wide experience in all kinds of pattern making. Can make drawings and work as leading man. Address P., AM. MACHINIST.

Situation wanted, as foreman of a boiler shop. Have had 20 years' experience as foreman, and am conversant with marine stationary and locomotive work. Address George Marshall, care AMERICAN MACHINIST.

Wanted—A very skillful machinist, for experimental work. One acquainted with gun work preferred. None but first-class need apply. Reference required. Apply to S. R. Krom, 93 Washington street, New York.

A thoroughly educated mechanical engineer and draughtsman, well posted in steam engineering, desires an engagement enabling him to prove his worth. Highest references from leading American and foreign shops. Has designed original machines for leading firms. Address "Box 7," AM. MACHINIST.

Situation wanted—By a foreman blacksmith, familiar with drawings and details, reverberatory furnace, steam hammer, marine and stationary and locomotive engine work, machine and job repair work—work up all scrap possible—good executive ability, reliable habits. First-class references given. Address A. B. C, care of AM. MACHINIST office.

The advertiser, who represents a new, important, and rapidly-growing industry, desires to correspond with a few intelligent mechanics or steam engineers, whose education and experience has fitted them to quickly learn the peculiarities of the business, with a view of placing them in charge of special branches. The positions are responsible ones, and require five competent and reliable men, of good character, habits, and address, with some knowledge of business and draughting, and experience in handling men. Address, giving age, acquirements, special experience, whether married or single: and references, Box 12. AM. MACHINIST.

FOR SALE—Harris-Corliss horizontal condensing double engine, cylinders 20x42 and 18x42. Wheel 16 feet diameter and 39 inch face. In good order; replaced by larger engine.

To be seen at Planet Mills, 372 President street, Brooklyn, N. Y.

FOR SALE.

The property formerly occupied by THE WOODRUFF & BEACH IRON WORKS, now **HARTFORD ENGINEERING COMPANY.** Said property is unsurpassed as to shops and buildings, conveniently located for transportation by water and rail, with a FIRST-CLASS EQUIPMENT of MACHINE TOOLS, bought within two years, adapted to engine building and general machine work. FIRST-CLASS FOUNDRY; STEAM CRANE, CAPACITY 20 TONS. And the largest collection of PATTERNS of all descriptions in New England.

E. M. BUNCE, Receiver,
Hartford, Conn.

BORING MILL WANTED.

Good modern built Boring Mill, either new or second-hand, about eight feet swing. Address,

EDMUND M. IVENS & SON,
NEW ORLEANS, LA.

If You Want the Best STEAM PUMP

For Mining, Railroad or Steamboat use, Paper Mill, Chemical or Gas Works, Tannery, Brewery or Sugar Refinery, Drainage Quarries, Cellars or Plantations Irrigating or Hydraulic Mining, Sinking Foundations, Coffer Dam, Sewer, Well Sinking and other Contractors' Work, or Raising Water for any kind of Manufacturing or Fire Purpose, write for an illustrated descriptive book on the New Pulsometer, containing greatly reduced prices, hundreds of testimonials, etc. Mailed free. Prices 100 per cent. lower than others.

Every pump tested before shipment and guaranteed as represented. Economy and Efficiency Unequaled. Pulsometer Steam Pump Co. 83 John St., N. Y. See prices next issue of this paper

NOTES IN MECHANICAL ENGINEERING.

Compiled principally for Students, but also of great value to all Mechanical Engineers. By HENRY ADAMS. 93 pages, 12mo, $1. Descriptive Catalogue (100 pages) free

E. & F. N. SPON, 35 Murray St., N. Y.

HILL, CLARKE & CO.

36 OLIVER STREET,
Boston, Mass.
BRANCH OFFICE, 800 N. 2nd STREET,
St. Louis Mo.

Have just issued new

CATALOGUE

—OF—

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Sent free to Manufacturers and Dealers on receipt of their business card.

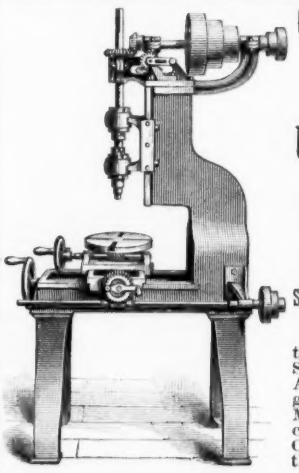
BRADLEY'S HEATING FORGES.

FOR HARD COAL OR COKE.

INDISPENSABLE IN ALL SHOPS to keep **Bradley's Cushioned Hammers** and men fully employed, and reduces cost of production.

BRADLEY & CO., Syracuse, N. Y.
(Established 1832.)

All descriptions of Gear Wheels or Gear Cutting to order.
Large variety of Ready-made Gears in Stock.
Send for Gear Book, gratis.
GEO. B. GRANT, - 3 ALDEN STREET, BOSTON.



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239 Centre St.,
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Manufacturer of

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Special Machinery.

Also manufactures a Gear and Spiral Cutting Attachment to go with Upright Milling Machine. And Cam Cutting done for the Trade.

COOKE & CO., DEALERS IN

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The Waters Perfect Governor.

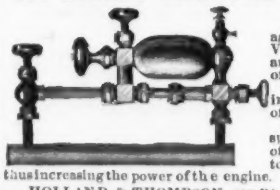
Having Adjustable Speed, Automatic Safety Stop, Sawyer's Lever, and Solid Composition Valves and Seats. Also

SUPPLIES

For Machinists, Railways, Mills, Mines, &c.

Please send for circular and state that you saw the advertisement in this paper.

THE HOLLAND LUBRICATOR VISIBLE DROP,



Is guaranteed to be
1. A perfect insurance against the cutting of Valve-seats, Cylinder and Governor Valves of the engine.
2. It will pay for itself in 6 months in saving of oil, coal, and packing.
3. It will insure more speed in the revolutions of the engine, say from 1 to 2 strokes per minute, thus increasing the power of the engine. Manufactured by

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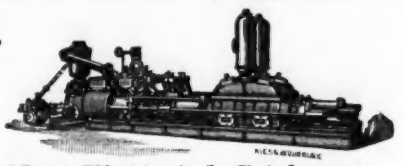

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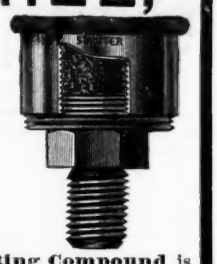

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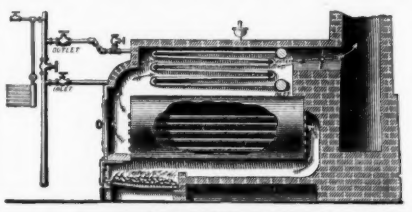

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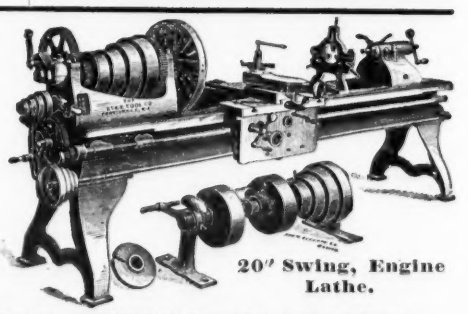

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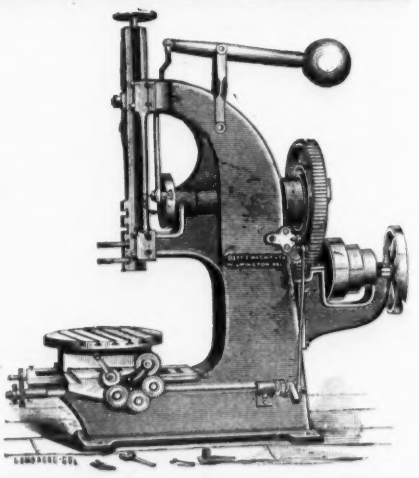

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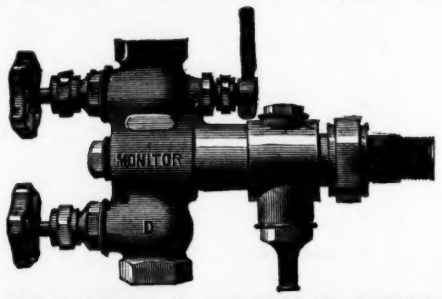

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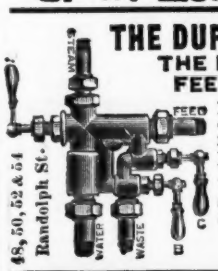

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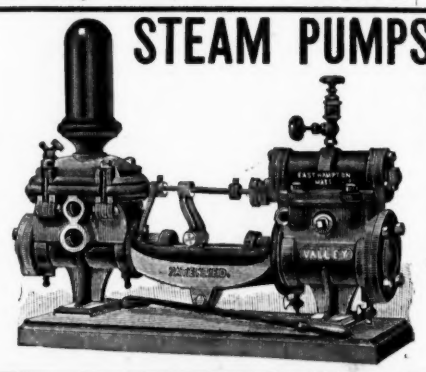

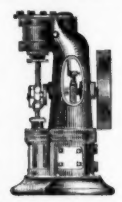

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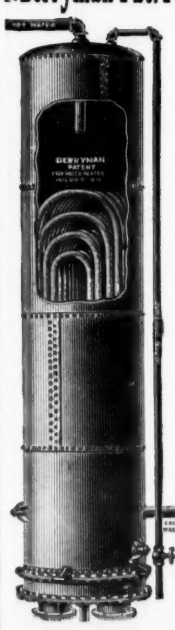

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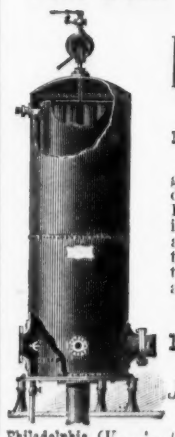

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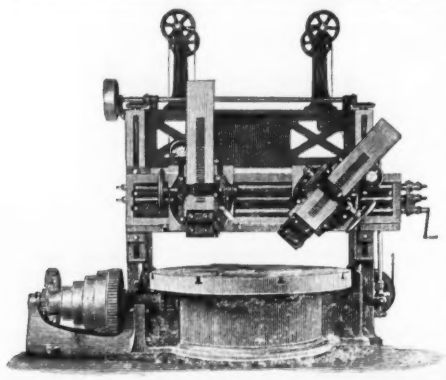

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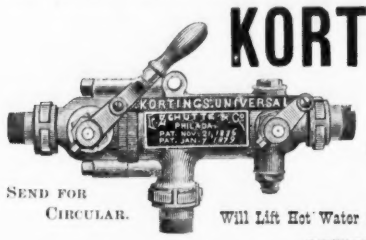

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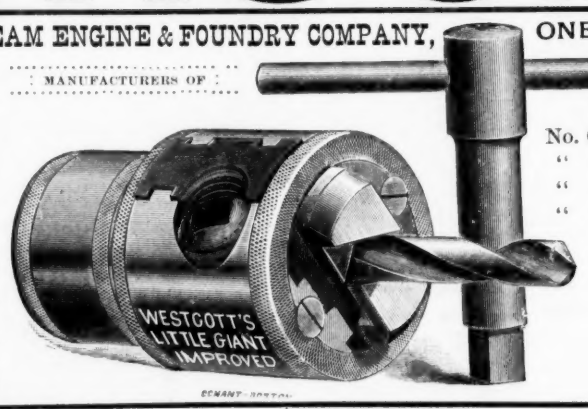

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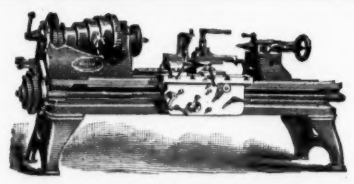

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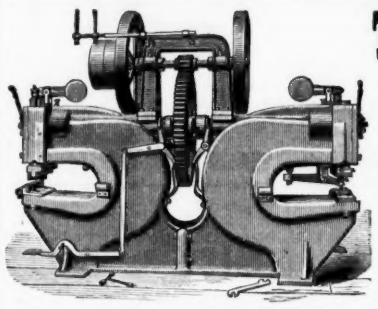

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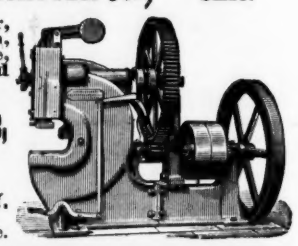

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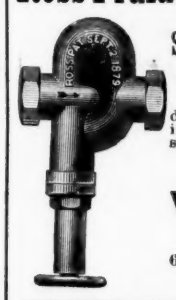

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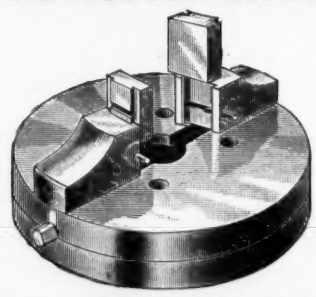

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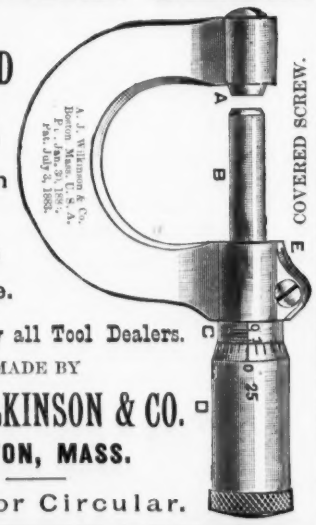

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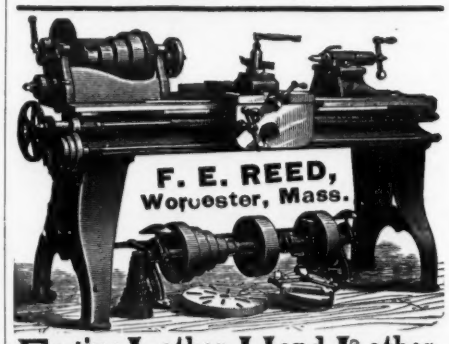

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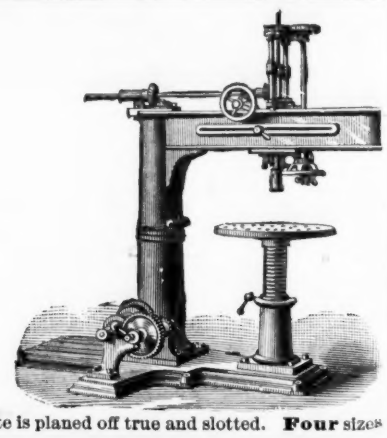

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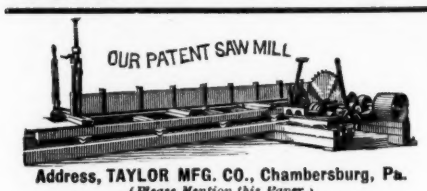

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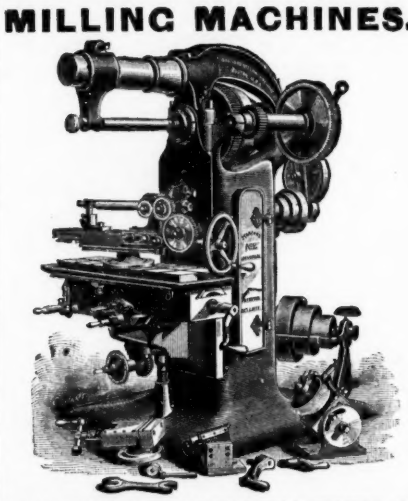

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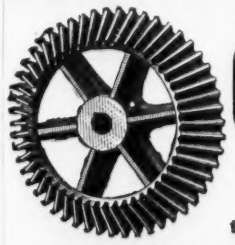

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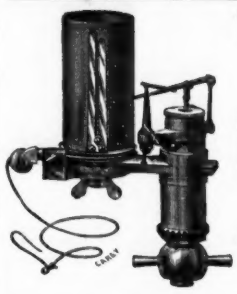

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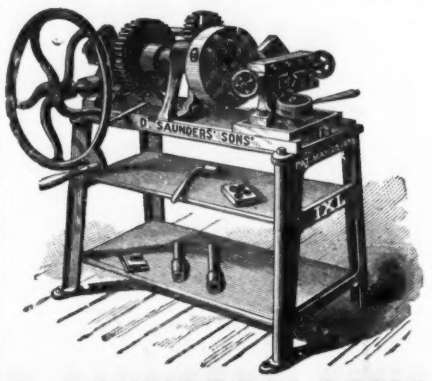

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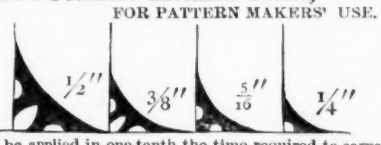

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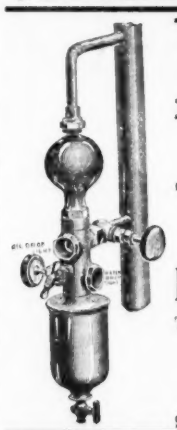

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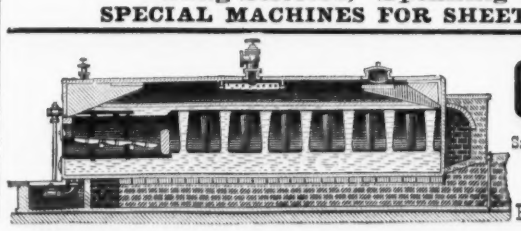

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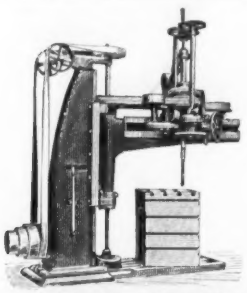

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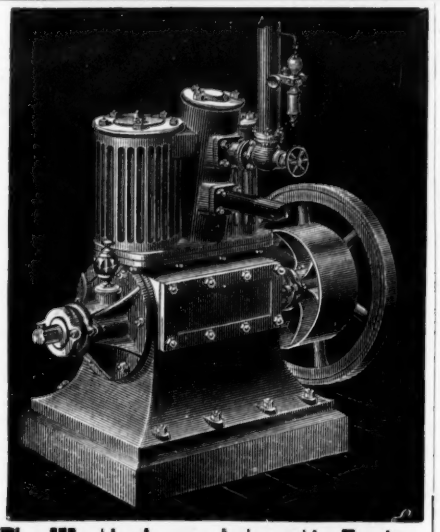

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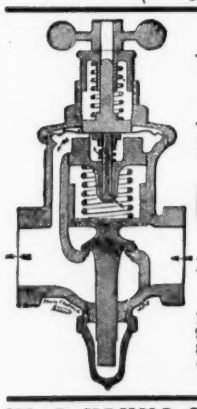

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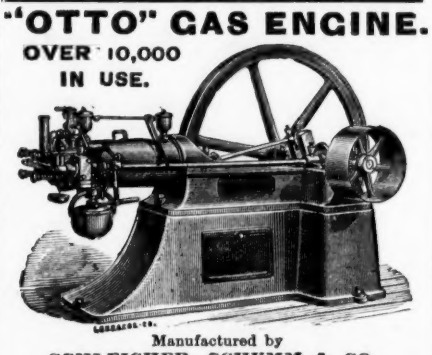

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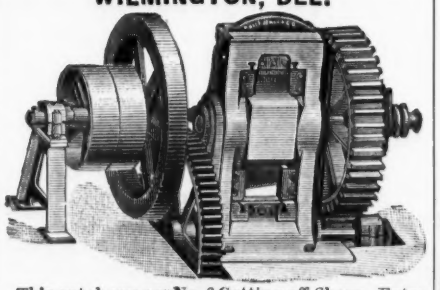

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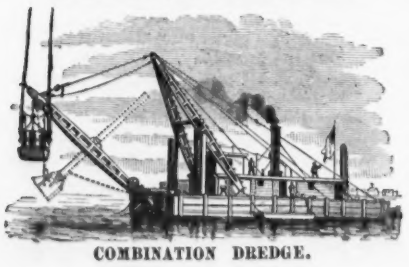

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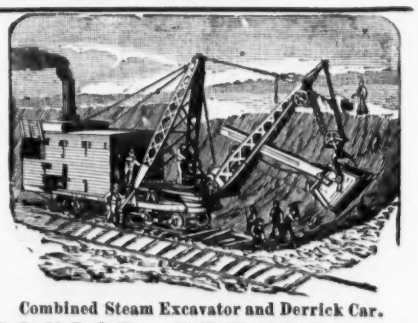

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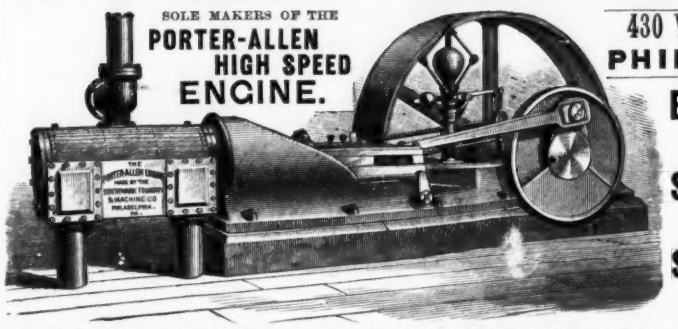

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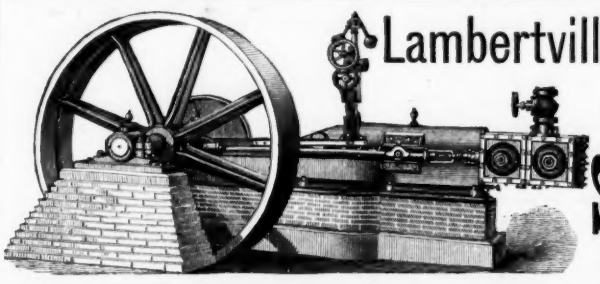

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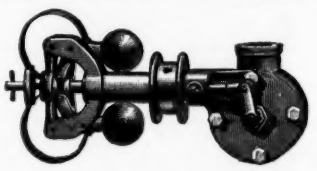

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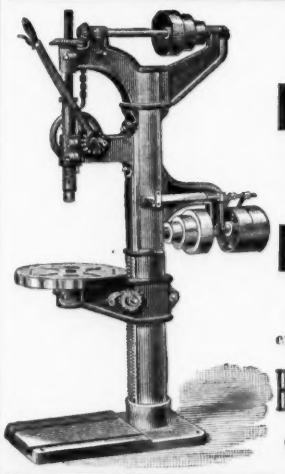

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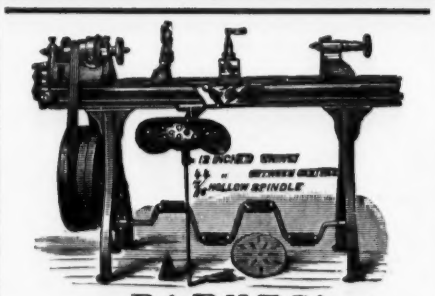

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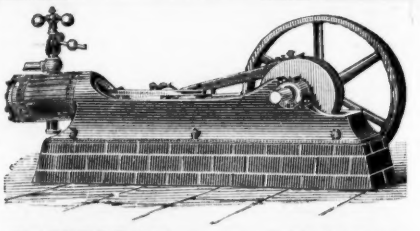

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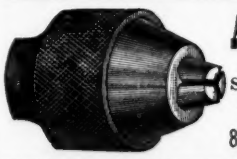

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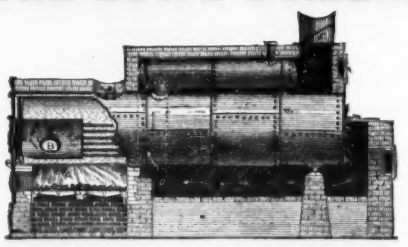

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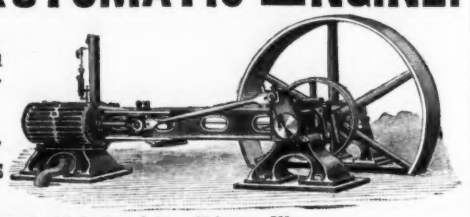

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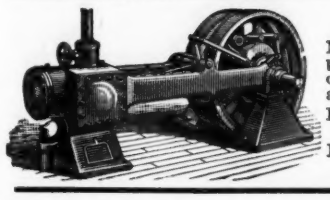

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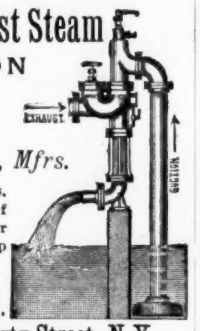

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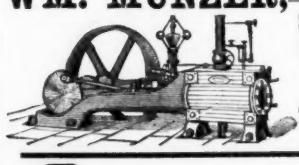

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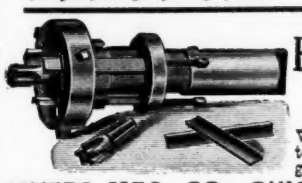

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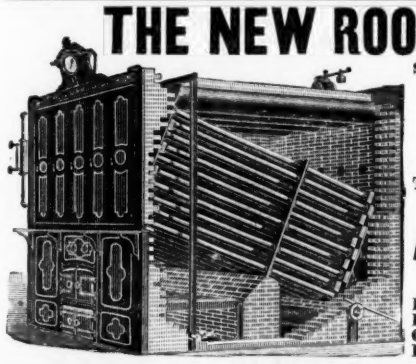

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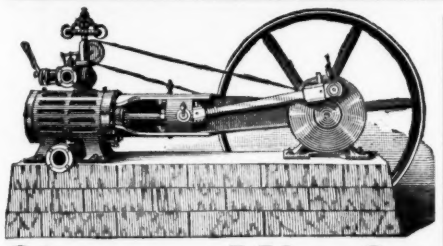

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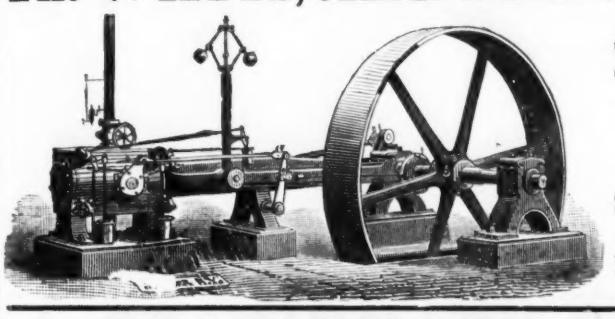

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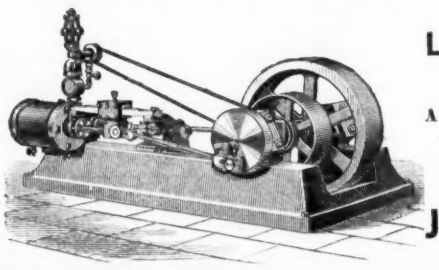

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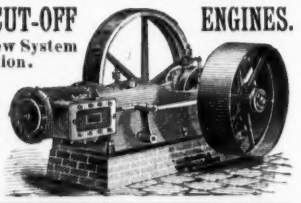

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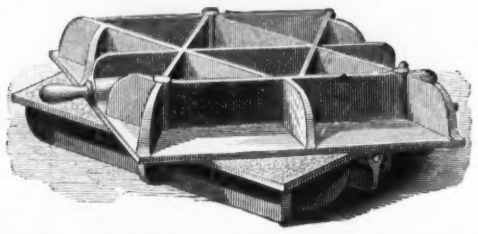

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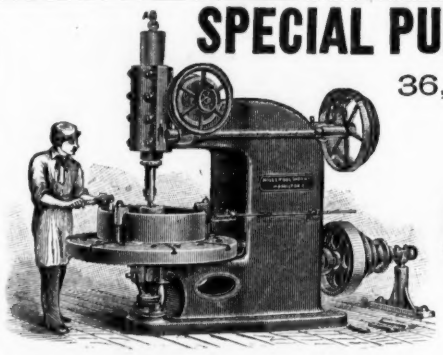

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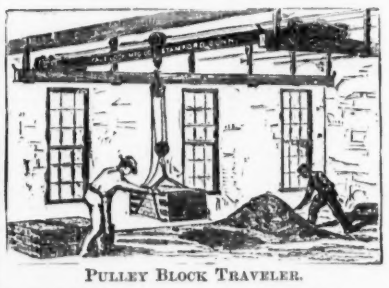

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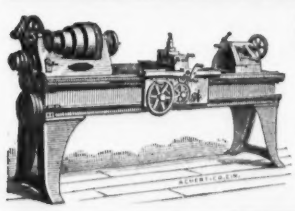

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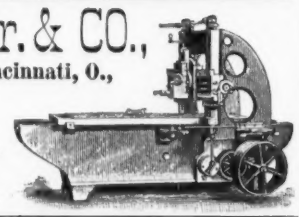

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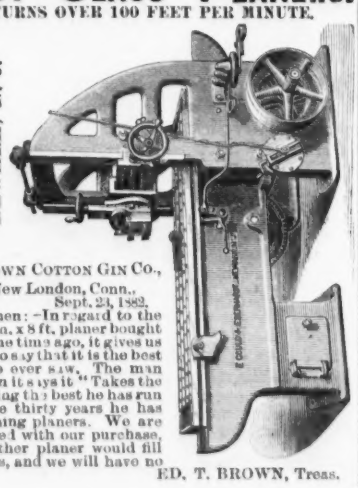

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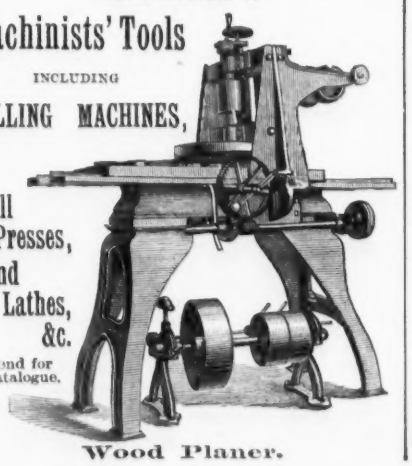

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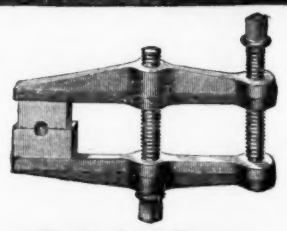

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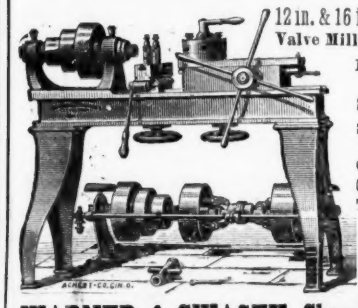

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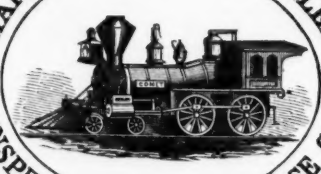

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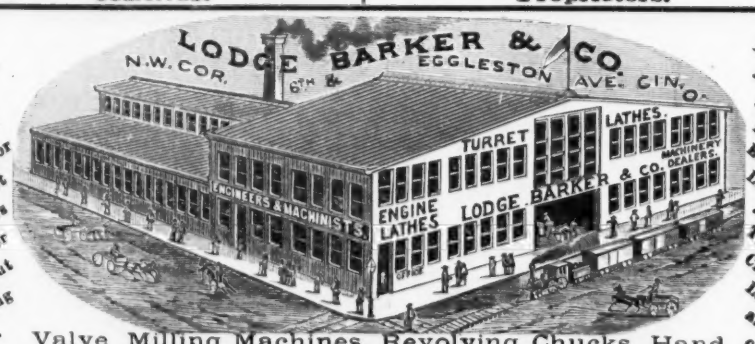
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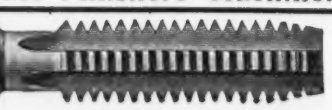

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